HEALTH TECHNOLOGY ASSESSMENT TOOL - TELEMEDICINE
By
CONTRACTOR: Toigo Associates, Inc.

Phase I Re-engineering Laboratory

Contract Study

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ABSTRACT

Health Technology Assessment Tool-Telemedicine
Phase I - Final Report

The goal of this study is to design a prototype assessment tool for evaluating technologies relevant to Telemedicine. The assessment tool will be used to guide future investments and review and analyze current AMEDD projects in Telemedicine.

HEALTH TECHNOLOGY ASSESSMENT TOOL – TELEMEDICINE

RE-ENGINEERING LABORATORY

Phase I Final Report

Toigo Associates, Inc.

July 15, 1998

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EXECUTIVE SUMMARY

In December 1992, Lieutenant General Alcide LaNoue, U.S. Army Surgeon General, established the Advanced Medical Technology and Telemedicine Initiatives, as " ...a method of projecting the consultative skills of a medical center to field hospitals", with the US Army Medical Department dedicated to becoming the world-wide leader and proponent for advanced, high-technology health care delivery systems to minimize combat casualties on the battlefield[1] or wherever deployed. This vision initiated a flurry of programs of technology innovation under the rubric of "telemedicine".

After several years, DOD telemedicine programs overall were examined by the GAO, which published results in Telemedicine: Federal Strategy is Needed to Guide Investments released in February 1997[2]. This report criticized the host of federal initiatives in telemedicine for not articulating a coherent strategy for their investments. The DOD received a predominance of attention in the GAO report since it "is the largest federal investor with $262 million and considered a leader in developing this technology."[3]

The ultimate findings of the report, especially concerning the performance of the DOD, strongly conclude that the lack of an overall "department-wide strategy" has hindered a wise stewardship of the financial investment[4]. The report also concludes that due to a lack of clear data it is still hard at this point to confidently state whether telemedicine can demonstrate any clear benefits, either by lowering the cost of delivery or by enhancing clinical effectiveness[5].

In order to help address GAO concerns, under the guidance LTG Ronald R. Blanck, TSG and MG James B. Peake, CG, AMEDD Center and School, the Re-Engineering Laboratory (REL) was contracted to develop an assessment tool and employ it to analyze current Army Medical Department (AMEDD) or AMEDD-led telemedicine initiatives in TRICARE Region 6.

The focus of the study was to examine what was the factual landscape regarding telemedicine across the entire region with a special emphasis on the user community. Visits were scheduled with both clinical and technical staff to see how they were applying the tools of telemedicine technologies, e.g. telecommunications, computers, etc. for the diagnosing and treating of patients. Issues, such as clinical enhancements and costs effectiveness were to be highlighted and catalogued, if possible, later analyzed and applied to strategic planning processes.

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[1] Telemedicine Research Laboratory, "Army Applied Medical Technology Overview", TRL: Cutting Edge Medical Technology.
[2] GAO, Telemedicine: Federal Strategy is Needed to Guide Investments, (Washington D.C.: GAO, 1997)
[3] GAO, pp. 3
[4] GAO, pp. 34
[5] CAO, pp. 75

The REL tasks include:

- Develop a health technology assessment tool to evaluate the effectiveness of current AMEDD and AMEDD-led telemedicine initiatives. Success criteria include, but are not limited to:

    - Achieving specific telemedicine initiative project objectives

    - Keeping active duty forces on the job and taking healthcare to the field

    - Enhancing and measuring the health and fitness of the force

    - Modifying the total Military Health Services System (MHSS) staffing model to reduce the size and skill mix requirement for support of military operations

    - Increasing the efficiency of the MHSS staff in peacetime, maintaining military readiness skills of the MHSS active duty staff, and reducing the health service requirements of TRICARE contractors

In addition,

- Analyze current AMEDD and AMEDD-led telemedicine initiatives within the DOD Telemedicine Testbed Database using the telemedicine health technology assessment tool. The assessment tool will incorporate the following criteria into the development methodology:

    - Group similar AMEDD and AMEDD-led telemedicine initiatives based on obvious relationships

    - Sequence AMEDD and AMEDD-led telemedicine initiatives by rank order based on value derived by applying the criteria described above

    - Analyze initiatives for redundancy and identify superior AMEDD and AMEDD-led telemedicine initiatives based on criteria described above

    - Identify existing gaps between current AMEDD and AMEDD-led telemedicine initiatives and recommend new initiatives to accomplish the criteria described above

    - Analyze the merit of each AMEDD and AMEDD-led telemedicine initiatives against the criteria described above

In order to develop the health technology assessment tool for telemedicine, an examination was undertaken of critical factors or inhibitors that would stand in the way of successful telemedicine implementation in the AMEDD. This process was extended to the identification of technology, business, and delivery of care factors, which could be changed to reduce the impact of the inhibitors. These preliminary factors and their relative importance were determined by the use of the Analytic Hierarchy Process (AHP) and were subject to verification by the data collection results. The health technology assessment tool included several models based on the analytic hierarchy process and utilized the decision support software called Expert Choice™. These preliminary models included both types of models: evaluation and choice, and ratings.

Three sites, Brooke Army Medical Center (BAMC) at Fort Sam Houston, Darnell Army Community Hospital (DACH) at Ft. Hood, and Baynes-Jones Army Hospital (BJACH) at Ft. Polk, were selected by the Great Plains Regional Medical Command (GPRMC) and their telemedicine projects (initiatives) were identified for analysis. The technology profile served as a starting point for data collection of qualitative and quantitative data.

REL was courteously received throughout the AMEDD where respondents took valuable time to complete the survey as well as sharing their views. Among the participants, regardless of rank or specialization was a collective commitment and passion to reap the best from technology to better fulfill the mission goals of the AMEDD. Special appreciation is due to COL Stuart Baker and COL Harrison Hassell, M.D. for their thoughtful guidance, support and coordination.

1.   FINDINGS

1.1   Virtually no telemedicine systems were operational at the time of REL data collection.

1.2   There was not much data available and what was available was not what was needed.

1.3   It was difficult to determine relative importance and weighting factors needed to evaluate the AMEDD initiatives in Region 6.

1.4   There is no up-to-date, comprehensive and documented business plan for Region 6.

1.5   The initiatives within Region 6 are unfocused and did not have individual project management plans.

1.6   Telemedicine information is being shared within Region 6.

1.7   There is clinician interest in leveraging telemedicine and information technology to enhance quality and efficiency of care with users looking forward to a meaningful role in the decision process for the adoption of future technology applications.

2.0   RECOMMENDATIONS

2.1   Conduct specific decision-making sessions supported by an AHP tool to verify the preliminary telemedicine objectives with the purpose of synthesizing relative priority and weights.

2.2   Initiate data collection within Region 6 to support the AHP model data input.

2.3   Re-evaluate existing telemedicine equipment within the region to assess effectiveness for current and future needs and with clinician participating fully in the evaluation process.

2.4   Adopt a project management focus at the initiative level.

2.5   Conduct periodic project audits to assess the return-on-investment and capture lessons learned for long-term improvement within the region.

2.6   Develop an overarching AMEDD telemedicine business plan for Region 6 based on application of the AHP Model.

1. ABSTRACT

This report describes the development of a telemedicine health technology assessment tool using the Analytic Hierarchy Process and its application in the analysis of current Army Medical Department (AMEDD) or AMEDD-led telemedicine initiatives in TRICARE Region 6. As published in the GAO report, Telemedicine: Federal Strategy is Needed to Guide Investments, 02/14/97, GAO/NSIAD/HEHS-97-67 the GAO recommends that the Secretary of Defense develop and submit to Congress an overarching telemedicine research and development and operational strategy. To provide AMEDD input to DOD policymakers, a health technology assessment of current AMEDD and AMEDD-led telemedicine initiatives is needed to identify the scope of current programs and the relative benefit added by each program to the healthcare delivery mission of the AMEDD

In order to develop the health technology assessment tool for telemedicine, an examination was undertaken of critical factors or inhibitors that would stand in the way of successful telemedicine implementation in the AMEDD. This process was extended to the identification of technology, business, and delivery of care factors, which could be changed to reduce the impact of the inhibitors. These preliminary factors and their relative importance were determined by the use of the Analytic Hierarchy Process (AHP) and were subject to verification by the data collection results.

The health technology assessment tool included several models based on the Analytic Hierarchy Process and utilized the decision support software Expert Choice™. These preliminary models included two types of models: evaluation and choice, and ratings. The REL team constructed the models with the assistance and guidance of experienced practitioners of AHP/Expert Choice to include Dr. Ernest Forman (patent holder of AHP/Expert Choice) and Ms. Cynthia Knott, a Ph.D. candidate under advisement of Dr. Ernest H. Forman).

Three sites selected for analysis within the Great Plains Regional Medical Command (GPRMC) were Brooke Army Medical Center (BAMC) at Fort Sam Houston, Texas; Darnall Army Community Hospital (DACH) at Fort Hood, Texas; and Bayne-Jones Army Community Hospital (BJACH) at Fort Polk, Louisiana. The Technology Profile served as a starting point for data collection of qualitative and quantitative data. Unfortunately, there was insufficient data for any type of conclusive analysis. Therefore, simulated data provided insight into the capabilities of the health technology assessment tool using the Analytic Hierarchy Process in the areas of resource allocation, cost-benefit analysis, cost-benefit-risk analysis, and optimization of benefits. The assessment tool provides the basis for recommendations for project prioritization and a starting point for additional analysis in developing an overarching AMEDD telemedicine strategy.

2.   BACKGROUND

HISTORY AND CONTEXT

In December 1992, Lieutenant General Alcide LaNoue, United States (U.S.) Army Surgeon General, established the Advanced Medical Technology and Telemedicine Initiatives, as " ...a method of projecting the consultative skills of a medical center to field hospitals", with the U. S. Army Medical Department dedicated to becoming the world-wide leader and proponent for advanced, high-technology health care delivery systems to minimize combat casualties on the battlefield[1] or wherever deployed. The "high-technology" component of these activities rests on the current proliferation in biosensors, computer and telecommunication systems promulgated by a number of key Department of Defense (DOD) organizations, including the U.S. Army Medical Research and Materiel Command (USAMRMC) and Defense Advanced Research Projects Agency (DARPA).

These organizations have been the central springboard for the emergence of a national and international debate on the potential of digital medicine or, as is now generically called, "telemedicine" to reengineer the way that the health care industry is supported. Extensive press coverage, conferences, and publications have generated widespread excitement and expectations.

The United States Congress is intensively interested in the applications and implications of telemedicine on national health policy. It has held a number of hearings and actual "on-site" demonstrations in the Capitol building[2]. As a consequence, both Congress and the White House are focused on how "telemedicine" could help resolve some of the complex issues that surround the health care policy debates over the last few years[3]. Telemedicine seems to offer a method which can help to address issues such as access and lower costs. Internal and external DOD publications and presentations have had an important effect in introducing telemedicine's potential. As a result, the DOD has found itself, at times, willingly or not, the source of verification and wisdom on the state of the progress of "telemedicine".

Like the DOD, many other Federal agencies have made investments in telemedicine, but nowhere are their efforts at the level, commitment, and intensity of the DOD. As with any high-visibility and high-risk technology venture, public review is understandable. Review and scrutiny, official and unofficial, is helpful because of the logical implications for not only military health care delivery but also for civilian healthcare.

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[1] Telemedicine Research Laboratory, "Army Applied Medical Technology Overview", Telemedicine Research Laboratory (TRL): Cutting Edge Medical Technology.
[2] House of Representative, Subcommittee on Technology, Committee on Science, Medical Technology Development and Commercialization, (Washington D.C.: Committee Hearings of U.S. House of Representatives, 1995)
[3] U.S. Department of Commerce, NTIA, Telemedicine Report to Congress, (Washington D.C.: U.S. Department of Commerce, 1997)

The Government Accounting Office (GAO) conducted an extensive and organized review of recent government assessments entitled <u>Telemedicine: Federal Strategy is Needed to Guide Investments</u>, released in February 1997[4]. The overall assessment and conclusions of this report reflect Federal and State activities. The reason for focus on the DOD in the GAO report is the fact that it "…is the largest federal investor with $262 million and considered a leader in developing this technology."[5]

The ultimate findings of the report, especially on the performance of the DOD, conclude that the lack of an overall "department-wide strategy" has hindered a wise stewardship of the financial investment[6]. The report also concludes that due to a lack of clear data it is still hard at this point to confidently state whether telemedicine can demonstrate any benefits, either by lowering the cost of delivery or by enhancing clinical effectiveness[7].

THE REL PROJECT

In order to help address GAO concerns, under the guidance LTG Ronald R. Blanck, TSG and MG James B. Peake, CG, AMEDD Center and School, the Re-Engineering Laboratory (REL) was contracted to develop an assessment tool and employ it to analyze current Army Medical Department (AMEDD) or AMEDD-led telemedicine initiatives in TRICARE Region 6.

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[4] [4] GAO, <u>Telemedicine: Federal Strategy is Needed to Guide Investments</u>, (Washington D.C.: GAO, 1997)
[5] GAO Report, pp. 3
[6] GAO Report, pp. 34
[7] GAO Report, pp. 75

3.   STATEMENT OF WORK

In order to help address GAO concerns, under the guidance LTG Ronald R. Blanck, TSG and MG James B. Peake, CG, AMEDD Center and School, the Re-Engineering Laboratory (REL) was contracted to develop an assessment tool and employ it to analyze current Army Medical Department (AMEDD) or AMEDD-led telemedicine initiatives in TRICARE Region 6.

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The REL tasks include:

THE TOOL
- Develop a health technology assessment tool to evaluate the effectiveness of current AMEDD and AMEDD-led telemedicine initiatives. Success criteria include, but are not limited to:

  - Achieving specific telemedicine initiative project objectives

  - Keeping active duty forces on the job and taking healthcare to the field

  - Enhancing and measuring the health and fitness of the force

  - Modifying the total Military Health Services System (MHSS) staffing model to reduce the size and skill mix requirement for support of military operations

  - Increasing the efficiency of the MHSS staff in peacetime, maintaining military readiness skills of the MHSS active duty staff, and reducing the health service requirements of TRICARE contractors

In addition,

THE ANALYSIS
- Analyze current AMEDD and AMEDD-led telemedicine initiatives within the DOD Telemedicine Testbed Database using the telemedicine health technology assessment tool. The assessment tool will incorporate the following criteria into the development methodology:

  - Group similar AMEDD and AMEDD-led telemedicine initiatives based on obvious relationships

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- Analyze the merit of each AMEDD and AMEDD-led telemedicine initiatives against the criteria described above

4. HEALTH TECHNOLOGY ASSESSMENT TOOL

4.1 ASSESSMENT TOOL DEVELOPMENT

The purpose of the study is to design a health technology assessment tool (assessment tool) to evaluate the effectiveness of current AMEDD and AMEDD-led telemedicine initiatives. The success criteria, given by the Telemedicine Board of Directors (TBOD), are:

- Achieving specific telemedicine initiative project objectives
- Keeping active duty forces on the job and taking healthcare to the field
- Enhancing and measuring the health and fitness of the force
- Reducing forward-deployed medical footprint to support lightning strike operations
- Modifying the total Military Health Services System staffing model to reduce the size and skill mix requirement for support off military operations
- Increasing the efficiency of the MHSS staff in peacetime, maintaining military readiness skills of the MHSS active duty staff, and reducing the health service requirements of TRICARE contractors

In order to meet the study's goals and objectives, the REL team 1) formulated objectives to determine what factors were critical to the AMEDD leadership in evaluating technologies, 2) designed a health technology assessment tool, 3) piloted the data collection process in TRICARE Region 6 for telemedicine, and 4) analyzed the results to the extent data was available for technical, operational, economic value using the Analytical Hierarchy Process (AHP).

The REL Health Technology Assessment Tool is not simply a set of questions (data call) or a computer simulation program (decision support system); It is a process by which the importance of various factors for technology investments are determined, selected, implemented and evaluated. The process is based on the Analytical Hierarchy Process described more fully in 4.1.3. Figure 1 shows how the first phase of this study relates to overall technology forecast and investment strategy (business plan).
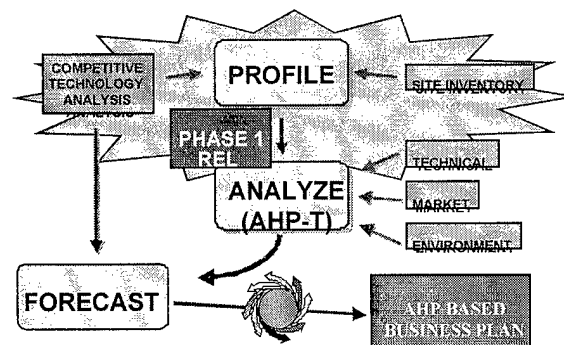
Figure 1 REL Health Technology Assessment Tool
(which show where the 1st phase fits into the overall process)

4.1.1 CRITICAL DETERMINANT FACTORS

Foremost in effective decision-making is the role of the leadership. The leadership must identify and agree on the critical factors and assign them a weight in order to make quality decisions. To deal with unstructured social, economic, and political issues, we need to order our priorities, to agree that one objective outweighs another in the short- or long-term, and to make tradeoffs to serve the greatest common interests.

Although the ultimate goal of the assessment tool is to determine future technology investments, factors, other than those in the technology arena, must also be examined. Some examples of these non-technology factors include business process, cost-benefit-risk tradeoffs, and ever-changing operational environments. In the present case, AMEDD critical factors may be viewed from three different perspectives: military, commercial, and medical perspectives.

MILITARY PERSPECTIVE:

From the military perspective, some critical factors include the continual shrinkage of the military size. Current and future missions will be diverse and may be of high intensity, short duration, and battlespace coverage. Critical cost-benefit assessments will shape the future military force, that is, the use of technology to replace soldiers on the battlefield.

COMMERCIAL PERSPECTIVE:

From the commercial perspective, some critical factors include the rapid incorporation of information technology into the industrial backbone in all market sectors. High consumer demands for information technology along with short product life cycles enhance the continued and unprecedented pace of technology development. Critical cost-benefit-risk analysis will again shape the commercial area as continued business re-engineering favors technology investments.

MEDICAL PERSPECTIVE:

From the medical perspective, critical factors for the deployed, beneficiary and non-operational forces are also changing. Some of these factors include the wide disbursement of combatants along with the limited number of combat troops which mandates the optimization of soldier performance with minimization of down time; the focus on treatments that allow soldiers to continue missions with decremented performance level; and shifting the focus from treatment in theater to stabilization only and treatment at home. The shift of beneficiary and non-operational healthcare to contractors, along with the introduction of contract healthcare support to the operational environment, also affects the peacetime health care system.

AMEDD recognizes the need to continue to leverage each investment in order to maximize returns. In the AMEDD, the reduction of financial, personnel and facility resources emphasizes AMEDD's challenge to reflectively develop and field complex new technologies when new technologies are expensive and sophisticated R&D may also be required. In addition, the technology product life cycle has become very short compared to traditional DOD timelines.

In summary, the factors mentioned above are examples of those critical to the AMEDD leadership as AMEDD evaluates current and future technology investments.

4.1.2 DECISION MAKING SYSTEM TECHNIQUES

According to Mason[8], a necessary condition for conceiving of something as a 'system' is that there is a decision-maker who – via resources – can produce changes.

> "In organizations, the decision-making function is the responsibility of management. In order to execute its responsibility, an organization's management requires information about the resources available to it and their relative effectiveness for achieving the organization" purposes. Resources are acquired, allocated, motivated and manipulated under the manager's control. They include people, materials, plant and equipment, money, and information[9]".

We are often forced to deal with more problems than we have resources to handle. To operate successfully, industry and government must organize their policies on the basis of short- and long-term thinking. They must integrate and synthesize a diversity of data and information. They need to deal with intangibles side by side with tangibles that have different scales[10]. How should these diverse scales be interpreted for decision making? Is it meaningful to mix dollars, tons, feet, and hours directly. If so, to what scale should they be converted and how are they combined for optimum results.

There are two fundamental approaches to solving problems: the "deductive" approach and the "systems" approach. Basically, the "deductive" approach focuses on the parts and the "systems" approach focuses on the workings of the whole.

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[8] Mason, Richard and Swanson, E. Burton, "California Management Review, Vol 21, No. 3 (Spring 1979) pp. 14
[9] Ibid.
[10] Saaty, Thomas, "Fundamentals of Decision Making and Priority Theory with the Analytic Hierarchy Process, Vol. VI, 1994, RWS Publications, Pittsburgh, PA, pp. 3

Decisions are based on judgements about impressions of reality which are often hazy. Logic is then used to defend the conclusions[11]. In order to make resource decisions in a rational way, an organization needs to do:

- Identify/design alternatives (e.g. alternative R&D projects, or operational plans for alternative levels of funding for each sub-organization)

- Identify and structure the organizational goals into objectives, sub-objectives, and so on

- Measure how well each alternative contributes to each of the lowest level of (sub) objectives

- Find the best combination of alternatives, subject to environmental and organizational constraints.

The Analytical Hierarchy Process (AHP) is a recognized method to combine the "deductive" and "system" approaches into one integrated, logical framework[12]. The Analytical Hierarchy Process organizes feelings, intuition, and logic in a structured approach to decision making. AHP serves as the foundation for the health technology assessment tool and the software package chosen for data analysis is Expert Choice™ Decision Support Software, a proven operational research tool based on AHP.

Before examining the project selection models in detail and AHP, two critically important, but often overlooked facts must be understood[13]:

- Models do not make decision; people do. The manager, not the model, bears the responsibility for the decision.

- All models, however sophisticated, are only partial representations of the reality they meant to reflect. Reality is far too complex for us to capture more than a small fraction of it in any model. Therefore, no model can yield an optimal decision except within its own, possibly inadequate, framework.

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[11] Ibid.
[12] Saaty, Thomas, "Decision Making for Leaders", 1996 RWS Publications, Pittsburgh, PA, pp. 13
[13] Meredith, Jack R., Mantel, Samuel J., Project Management: A Managerial Approach, Third Edition, 1995, John Wiley & Sons, Inc. pp. 43.

4.1.3 UNDERSTANDING THE TOOL - ANALYTICAL HIERARCHY PROCESS (AHP) METHOD

OVERVIEW

The Analytic Hierarchy Process was developed at the Wharton School of business over 20 years ago by Thomas L. Saaty and allows decision makers to model complex problems in a hierarchical structure showing the relationships of the goals, objectives (or criteria), (sub) objectives, and alternatives. First, it is useful to clarify the meaning of Analytic, Hierarchy, and Process used in AHP.

Analytic

Most organizations are proficient at this part of the method, that is, to analyze, to pull apart and examine the individual pieces. Analytic is a form of the word analysis, which may be defined as "separating into elemental parts or basic principles[14]. Although organizations are good at analysis, it does not often help them make better decisions. In order to use the analysis, the key is to synthesize the information, which involves combining all of the parts into a whole. Dr. Ernest H. Forman states, "in a sense, AHP should really be called Synthesis Hierarchy process because at its core, AHP helps us measure and synthesize the multiple factors involved in complex decisions[15]."

Hierarchy

Hierarchies are a fundamental tool of the human mind. The use of hierarchies involves identifying the elements of a problem, grouping the elements into homogeneous sets, and arranging these sets in different levels. Herbert A. Simon, father of the field of Artificial Intelligence and Nobel laureate, writes[16]:

> "Large organizations are almost universally hierarchical in structure. That is to say, they are divided into units which are subdivided into smaller units, which are, in turn, subdivided and so on. Hierarchical subdivision is not a characteristic that is particular to human organizations. It is common to virtually all complex systems of which we have knowledge... The near universality of hierarchy in the composition of complex systems suggest that there is something fundamental in this structure that goes beyond the peculiarities of human organizations. An

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[14] Webser's II New Riverside University Dictionary, 1994, Houghton Mifflin Company, Boston, MA, pp. 104.
[15] Forman, Ernest H, "Decision by Objectives", 1997, RWS Publications, Pittsburgh, PA, pp.
[16] Simon, Herbert A., "The New Science of Management Decision"., Harper and Brothers, New York, N.Y., 1960.

organization will tend to assume hierarchical form whenever the task environment is complex relative to the problem-solving and communicating powers of the organization members and their tools. Hierarchy is the adaptive form for finite intelligence to assume in the face of complexity.

Hierarchies can be divided into two kinds: structural and functional[17]. In structural hierarchies, complex systems are structured into their constituent parts in descending ordering according to *structural properties* such as size, shape, color, age, etc. Structural hierarchies relate closely to the way our brain analyzes complexity by breaking down the objects perceived by ours senses into clusters, (sub) clusters, and still smaller clusters.

In contrast, functional hierarchies decompose complex systems into their constituent parts according to their *essential relationships*. A conflict over selection of a new site for an Army Community Hospital can be structured into a cluster of major stakeholders (the troops, the AMEDD leadership, Congress, etc.), a cluster of stakeholder objectives (care for patients, best location, cost of construction, etc.), and alternative outcomes (selection of the various candidates). Functional hierarchies help people steer a system towards a desired goal such as conflict resolution, efficient performance, or overall happiness.

Figure 2 shows the hierarchical structure of the AHP model for the assessment tool.

LEVEL I: Goal

LEVEL II: Objectives

LEVEL III: (Sub) Objectives

LEVEL IV: Alternatives
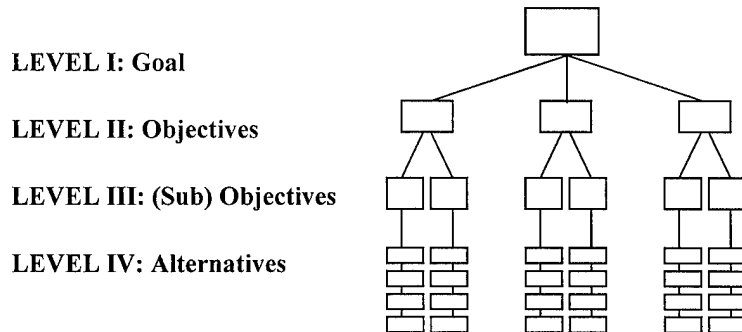
Figure 2 Structure of the AHP Health Technology Assessment
Tool for Telemedicine
(which shows the hierarchical structure of the assessment tool)

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[17] Saaty, Thomas, "Decision Making for Leaders", 1995, RWS Publications, Pittsburgh, PA, pp. 30

Process

A process indicates that it is not a static activity but allows for changes, as new information is available. Iterations are needed to create a meaningful and useful tool. Good decision making is also an iterative process.

AHP has been documented in over 1000 articles and doctoral dissertations[18]. Some users around the world include IBM, General Motors, Xerox, 3M, U.S. Navy, Rockwell International, and NASA. In the medical area, AHP publications included topics such as clinical decisions, determination of hospital requirements, priority assignments, and selection of a hospital[19]. AHP has demonstrated application in the areas of resource allocation[20], technology management[21,22], project selection[23,24], and cost-benefit analysis[25].

Basically, AHP is a set of axioms that carefully delimits the scope of the problem environment. It is based on the well-defined mathematical structure of consistent matrices and their associated right-eigenvector's ability to generate true or approximate weights. The AHP methodology compares criteria, or alternatives with respect to a criterion in a natural pair-wise mode. To do so, AHP uses a fundamental scale of absolute numbers that has been proven in practice and validated by physical and decision problem experiments. The fundamental scale converts individual preferences into ratio scale weights that can be combined into a linear additive weight $\omega(a)$ for each alternative a. The resultant $\omega(a)$ can be used to compare and rank the alternatives, hence, assist the decision-maker in making a choice.

The steps in decision making, such as: assigning priorities, evaluating variables, making trade-off evaluations, and integrating multiple points of view are standard and easy when decisions are simple. Unfortunately, as decisions become more complex – including more alternatives, more criteria and more variables – our ability to mentally manage, relate and evaluate all of the elements

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[18] http://www.ExpertChoice.com

[19] Tummala, R., Wan, Y.W., Analytic Hierarchy Process (AHP) in practice: A survey of applications and recent developments, 1993

[20] Bauer, R., Collar, E., Tang, V., *The Silverlake Project*, Transformation at IBM Silverlake Project: Transformation at IBM. Oxford University Press, New York, 1992.

[21] Manahan, M.O., Technology acquisition and research prioritization, International Journal of Technology Management, 1989, 4(1), pp. 9-19

[22] Carter, W.K., To invest in new technology or not? New tools for making the decision, Journal of Accountancy, 1992, 173(5), pp. 58-64

[23] Calhoun, J. K., Automated objectivity for subjective business decisions, Information Strategy: The Executive's Journal, 1989, 6(1), pp. 21-25

[24] Liberatore, M.J., An extension of analytic hierarchy process for industrial R&D project selection and resource allocation, IEEE Transactions on Engineering Management,1987, EM-34(1), pp. 12-18

[25] Bennet, J.P. & Saaty, T.L., Knapsack allocation of multiple resources in benefit-cost analysis by way of analytic hierarchy process, Mathematical and Computer Modelling, 1993, 17(4-5), pp. 55-72

deteriorate. As a result, the focuses of decision-makers are usually on just a few factors, weakening the ability to reach the best overall decisions.

A detailed description of the AHP theory is included in Appendix A. A detailed description of other types of project evaluation and selection model is included in Appendix B. These descriptions include both non-numeric and numeric models. Other operations research and economics models are described in later sections of this report including 6.1.3.7. In addition, Figure 3 summarizes the major advantages of the Analytic Hierarchy Process.

Unity:
The AHP provides a single, easily understood, flexible model for a wide range of unstructured problems.

Process Repetition:
The AHP enables people to refine their definitions of a problem and to improve their judgement and understanding through repetition.

Complexity:
The AHP integrates deductive and systems approaches in solving complex problems.

Judgement and Consensus:
The AHP does not insist on consensus but synthesizes a representative outcome from diverse judgements.

Interdependence:
The AHP can deal with interdependence of elements in a system and does not insist on linear thinking.

Tradeoffs:
The AHP takes into consideration the relative priorities of factors in a system and enables people to select the best alternatives based on their goals.

Hierarchic Structuring:
The AHP reflects the tendency of the mind to sort elements of a system into different levels and to group like elements in each level.

Synthesis:
The AHP leads to an overall estimate of the desirability of each alternative.

Consistency:
The AHP tracks the logical consistency of the judgements used in determining priorities.

Measurement:
The AHP provides a scale for measuring intangibles and a method for establishing Priorities.

Figure 3 Advantages of the Analytic Hierarchy Process[26]
(which shows the various advantages of AHP)

4.3.1.1 Development of Goal, Objectives and (Sub) Objectives

LEVEL 1: GOAL

The first step in the development of an AHP is to define the goal. This is the responsibility of the leadership. It is important to take time to do this well. Mission statements, purposes, scope, objectives, and goals are related and often confused or used interchangeably. Mission statement and purposes are most alike in meaning and can be considered at the top of a hierarchy of planning. Although goals and objectives are similar in meaning, in AHP, the goal closely aligns with the broader meaning of the mission and purpose while objectives are used with greater

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[26] Saaty, Thomas L., Decision Making for Leaders, 1996, RWS Publications, pp. 25

specificity and define what happens when the mission is completed.

LEVEL II: OBJECTIVES/CRITERION

A hierarchy can be constructed to represent the complex problem in a multilevel structure whose first level is the goal followed successively by levels of objectives, criteria, (sub) criteria, and so on down to a bottom level of alternatives. The objective of a hierarchy is to assess the impact of the elements of a higher level on those of a lower level or alternatively the contribution of elements in the lower level to the importance or fulfillment of the elements in the level above. This process is not necessarily linear but may involve functional independence.

For clarification, our operational definition of the 'best' choice is a rational or best choice that best meets the objective(s). For example, in making a choice between a large and small car, we consider the attribute 'size' of the car, or use 'size' as a criterion. We run into difficulty when trying to assess whether the large car is more preferable than the small car, since size has both pros and cons. Instead of considering size as an attribute or criterion, we can focus on the objectives. For example, the first objective is safety. With respect to safety, the large car is more preferable. With respect to the second objective handling, the small car is more preferable. Therefore, in selection of the 'best' telemedicine projects, multiple objectives such as size, ease of use, and reliability and quality of care are considered. The Telemedicine Profile, which appears in Appendix G, was used to collect data and to determine the level of importance the various objectives are to the AMEDD leadership and the user community.

In practice, there is no set procedure for generating the objectives, hierarchies, and activities (or initiatives) to be included in a hierarchy. It is a matter of what objectives we choose to decompose the complexity of the problem[27]. A useful criterion to check the validity of a hierarchy is to determine if the elements of an upper level can be used as common attributes to compare the elements in the level immediately below with each other. A valuable observation about hierarchical approach to problem solving is that the functional representation of a system may differ from person to person, but people tend to agree on the bottom level of alternative actions to be taken and the level above it[28].

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[27] Saaty, Thomas, "Fundamentals of Decision Making and Priority Theory with the Analytic Hierarchy Process", pp. 105-106
[28] Ibid.

4.1.3.2   Constructing Hierarchies

As mentioned above, hierarchies can be divided into two kinds: structural and functional. In our case, a functional hierarchy is more appropriate since the objective of a functional hierarchy is to help steer people towards an overall objective or goal. The overarching goal of the health technology assessment tool for telemedicine is to allocate resources to the telemedicine initiatives. There are two ways to build an AHP model: the top-down and the bottoms-up method.

Top-Down Construction

In the top-down approach, the numbers and types of alternatives are open and one attempts to find a best choice from what is available at the time. This method is used when the objectives and (sub) objectives are easily definable. For example, the top-down approach was used in allocating the overall financial resources among the 5 TBOD stated telemedicine criteria (objectives). This is a type of evaluation and choice (EC) model that results in a set of weights or proportional values which indicate the proportional allocation of resources in relation the five stated objectives. For example, if the weights were equal for all 5 TBOD objectives, i.e. 0.2 each, and the total financial resource pool was $100M, all projects that meet the peacetime objective would total up to 20% of $100M, i.e. $20M.

Bottoms-Up Construction

In the bottoms-up process, the alternatives are known, generally exhaustive and one wants to choose a best one or allocate resources among them. A common 'formal' approach to making choices among alternative is to list the pros and cons of each alternative. The result is the evaluation of the factors that are useful in the definition and identification of the organization's objectives. The bottoms-up approach is used to evaluate the alternatives and to allocate resources among them.

4.1.3.3 Pair-wise Comparisons and Synthesis

Once the hierarchy is constructed with the goals, objectives, (sub) objectives, criterions, (sub) criterions, and alternatives, AHP method derives ratio scales of relative magnitudes of a set of elements by making paired comparisons. The comparisons proceed from judgements on comparisons with respect to dominance, which is the generic term for expressing importance, preference or likelihood, of a property which they

have in common, to their numerical representation according to the strength of that dominance and then derives a ratio scale. Thus, decision making with AHP is based on ranking activities in terms of relative ratio scales[29]. These judgements may be made using either a verbal, graphic or numeric method by either in person or via questionnaires.

With tangible attributes, we use our instruments and senses to estimate how the objects/activities differ with respect to dominance. With intangible attributes, we must use our feelings and experience to make such comparisons. Humans have the intrinsic ability of consciousness to make comparisons based on feelings and experiences. Both tangibles and intangibles can be used to create a ratio scale of absolute numbers, which represent their strengths.

The misuse of numbers is one reason that numerical analyses are sometimes flawed. In order to avoid such errors, levels of measurement are reviewed in Appendix B. The four classifications given by R. S. Stevens are the nominal, ordinal, interval and ratio scales[30]. The health technology assessment tool is based on ratio scales.

4.1.3.4 Channel Capacity and Short-term Memory

Experiments have proven time and time again that the human brain is limited in both its short-term memory capacity and its discrimination ability (channel capacity) to about seven things.

According to James Martin[31], if a person "has to choose between a range of 20 alternatives, he will give inaccurate answers because the range exceeds the bandwidth of his channel for perception. In many cases, seven alternatives are the approximate limit of his channel capacity". Martin's conclusions are based on the results of numerous psychological experiments, including the well know study "The Magical Number Seven, plus or minus Two: Some Limits on Our Capacity for Information Processing," by G. A. Miller.[32]

As mentioned in 4.1.3, Herbert A. Simon, the 1978 Nobel Laureate in Economics, the founding father of artificial intelligence, stated that most of our decisions are based on short-term memory. A maximum of

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[29] Ibid., pp. 8
[30] Stevens, S. S. ,"On the Theory of Scales of Measurement", Science, (103, 1946), pp. 677-680.
[31] Martin, James, Design of Man-Computer Dialogues, (Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1973).
[32] Miller, G. A., "The Magical Number Seven, Plus or Minus Two: Some Limits on Our Capacity for Information Processing." Psychological Review, (Vol. 63, No. 2, March 1996), pp. 81-97. The distribution is a bell shaped curve with an average of 7. Only about 11 percent of the population can recall 9 things from their short-term member, still fewer at 10 things, and so on.

seven pieces of information is used in making decisions[33]. However, most people use only three to four on the average.

4.1.3.5 Consistency

The AHP model, unlike an unweighted or weighted linear model, does not demand perfect consistency and allows for inconsistencies. AHP also provides a measure of the inconsistency in each set of judgements. The real world is hardly consistent but it is natural for humans to want to be consistent. An inconsistency ratio of about 10% or less is usually considered 'acceptable'. An inconsistency ratio of 100% is equivalent to random judgements. The most common causes of inconsistency includes:

- Clerical Error (most common cause)
- Lack of information
- Lack of concentration during the judgement process
- Lack of consistency in whatever is being modeled
- Inadequate model structure

It is important that low consistency not become the goal of the decision making process. A low consistency is necessary but not sufficient for a good decision.

4.1.3.6 Evaluation and Choice[34]

The decision-maker's judgments form the basis of the Evaluation and Choice (EC) process. Judgments are made about pairs of elements relevant to a criterion or property, which they have in common. For example, we look at two stars and notice that the first star is brighter than the second star. In addition to observing this, we have the ability to say that the first star is much brighter than the second star, or just moderately brighter, or that the brightness of the two stars is the same. It is from a multiplicity of these pair-wise comparisons that we build our knowledge of the variability of a criterion that interests us.

Just as we can distinguish and measure physical quantities such as meters for length or seconds for time, we are able to do the same with our perceptions of other qualities. We have the capacity to experience a wide range of feelings and discriminations. This permits us to develop relationships among the elements of a problem and to determine which elements have the greatest impact.

[33] Simon, Herbert A. , Theories of Decision-Making in Economics and Behavioral Science, The American Economic Review, Vol. 49, No. 3, (June, 1959), pp. 253-283.

[34] Expert Choice™ Tutorial Version 9.0, Expert Choice Decision Support Software, Pittsburgh, PA 1995.

There are three ways to enter pair-wise comparisons in Evaluation and Choice: the Verbal mode, the Numerical mode (numerical matrix or questionnaire), and the Graphical mode. One can express the relative importance of one element over another with respect to a given criterion either verbally or numerically. When making comparisons in a social, psychological, or political context, the VERBAL comparison mode of Evaluation and Choice may be preferred. When comparing economic or other measurable factors, the NUMERICAL comparison mode may be preferred. Table 1 explains both scales and their relationship used in the assessment tool.

Intensity of Importance	Definition	Explanation
1	Equal importance	Two activities contribute equally to the objective
2	Weak	
3	Moderate importance	Experience and judgement slightly favor one activity over another
4	Moderate plus	
5	Strong importance	Experience and judgement strongly favor one activity over another
6	Strong plus	
7	Very strong or demonstrated importance	An activity is favored very strongly over another: its dominance demonstrated in practice
8	Very, very strong	
9	Extreme importance	The evidence favoring one activity over another is of the highest possible order of affirmation
Reciprocals Of above	If activity i has one of the above nonzero numbers assigned to it when compared with activity j, then j has the reciprocal value when compared with i.	
Rationals	Ratios arising from the scale	If consistency were to be forced by obtaining n numerical values to span the matrix

Table 1 The Fundamental Scale used in the assessment tool
(which defines the intensity of importance of the fundamental scale)

Synthesis is the process of weighting and combining priorities throughout the model that leads to the overall results. Synthesis from the goal node multiplies the weight of each parent node times the local priorities of its children nodes and of those children times the local priorities of their children. This process continues down to and including the alternatives.

Synthesis converts all the local priorities into global priorities throughout the model, the object being to obtain global weights for the alternatives. The global weights for each alternative are summed to get its final synthesized weight, or overall priority. A sensitivity analysis may then be performed to determine how sensitive the result is to changes in the priority of the criteria.

4.1.3.7 The Ratings Method[35]

The ratings method combines the power of the hierarchy and pair-wise comparison process with the capability to rate hundreds of alternatives. The model enables decision-makers to easily evaluate a large number of alternatives. Ratings should only be used when decision-makers have a thorough understanding of their objectives and can thereby generate meaningful scales, for rating alternatives, under the objectives and (sub) objectives. These scales may be relative or absolute scales.

After a panel review of each telemedicine initiative and data presentation, the health technology assessment tool using AHP can generate ratings for each initiative. The rating method for decision modeling is used to compare alternatives against the same standards. These standards appear under the lowest level (sub) criteria at the bottom of the model. They are nodes that we refer to as intensities. The scale of intensities for each criterion (objective or (sub) objective) is then used to evaluate each alternative. The scores for each alternative are weighted according to the priorities derived from the pair-wise comparison process and then summed to determine the overall score. A preliminary scale of intensities for our telemedicine case is shown in Appendix E.

4.1.3.8 Resource Allocation Methods

COST-BENEFIT ANALYSIS OR (BENEFIT/COST RATIOS OR B/C RATIOS)

One of the most widely used approaches to resource allocations is cost-benefit analysis. Organizations have used cost-benefit

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[35] Expert Choice™ Tutorial Version 9.0, Expert Choice Decision Support Software, Pittsburgh, PA 1995.

analysis for quite some time. Given the benefits and costs, the B/C ratios may be easily calculated by numeric division. Such studies have often faltered because of the difficulty in quantifying benefits. Costs were much easier to quantify. For example, in choosing a car, we may consider both performance and maintenance requirements as objectives. The former is clearly a benefit and the later a cost. When we compare alternative cars with respect to these objectives, we ask which car is more preferable. A high performing car is more preferable than a low performing car. A car requiring low maintenance is more preferable than one requiring high maintenance.

The assumption is that an organization will consistently follow the philosophy of maximizing its cumulative B/C ratio. Over time, the organization will also maximize their benefits. Although this is usually true, there are exceptions.

Instead of including benefits and costs in a single hierarchy, a cost-benefit approach can be taken in which one hierarchy is used to measure the benefits of the alternatives, and a second hierarchy, used to measure the costs of the alternative. The benefit priorities are similar only in that they have the same alternatives. The benefit priorities from the benefits hierarchy are subsequently divided by the cost priorities from the cost hierarchy to give a measure of the benefit/cost ratio. This is mathematically meaningful because each hierarchy produces ratio scale priorities and the ratio of ratio scale numbers is a ratio scale. The flexibility of separating benefit and cost allows for comparison between resource allocation methods such as cost-benefit, cost-benefit-risk, optimization of benefits, etc.

Optimization of Benefits

Another method for allocating resources seeks to find the best combination of projects or activities that maximizes the total benefit without exceeding the budget. This is the goal of the health technology assessment tool. Compared with some ambiguity of what maximizing the cumulative benefit/cost ratio may accomplish, the objective of maximizing benefits is straight forward, understandable, and does not depend on questionable underlying assumptions.

Some problems can be made more complex by introducing other constraints other than cost such as size, weight, and time. Constraints such as must fund projects may also be incorporated

into the model. In addition, positive and negative synergistic constraints may also be represented.

The benefit of the optimization approach to resource allocation is flexibility. Constraints may be added to fit almost any managerial need. Management may obtain an 'efficiency frontier' by plotting the total benefits against a range of funds. The decision-maker may examine this efficient frontier and decides which point is most desirable.

Comparison between B/C Ratio and Optimization of Benefits:

B/C Ratios:
- Cost is an objective because it goes into B/C Ratio
- If Cost (or unexpended funds) is not an objective, then B/C should not be used.
    - Pros: Easy to Solve.
    - Cons: Can lead to wrong answers if applied blindly (assumptions are difficult to verify)
    - Can only deal with one constraint

Optimization of Benefits:
- Cost may or may not be an objective
- If cost is an objective, then can include cost an objective in the hierarchy
- If not, cost may be considered as a constraint and optimize benefits over a range of total cost constraint values; or add percentage of unused budget as variable in optimization the objective function.
    - Pros: Easy to verify assumptions can include many types of constraints, very flexible.
    - Cons: may have to explain why replacing a higher B/C alternative with a more costly but lower B/C alternative as budget is increased, is in the best interest of the organization.

Comparison of results from maximizing B/C Ratios and maximizing benefits:

- Results are often quite close
- Identical results if budget limit corresponds to a cumulative cost break value
- Drastically different result are possible, especially in situations where cost, or unexpended funds are not important

     In discrete alternative resource allocation, each alternative is discrete from the other alternatives. In activity level resource allocation one or more levels of funding are considered for each alternative. For example, each project in an organization can be considered for funding at current levels, +/-5%, +/-10%, etc. A plan is developed specifying the type and extent of the activities each project would perform at each level of funding. AHP models may be constructed to value the expected contribution to the organization's objectives for each alternative level of funding. The health technology assessment tool is capable of performing activity level resource allocation.

4.2 EXPERT CHOICE™ DECISION SUPPORT SOFTWARE

    The assessment tool decision support system used to analyze the data collected is a proven operational research tool, Expert Choice™ Decision Support Software. AHP forms the basis for the software by providing a logical, easy-to-use framework which all the elements of a decision can be defined, organized, and carefully evaluated.

    The Expert Choice™ software allows the users to first define the decision problem as the goal, and structure the problems as levels of criteria or objectives within a hierarchical framework. Once these factors have been determined, the alternatives are placed at the bottom level of the hierarchy under each lowest level of (sub) criterion. The flexibility of the hierarchic structure allows the user to build models specific to the problem[36]. Expert Choice™ leads the decision-maker through a series of judgements between the alternatives under each criterion, and then between the criteria.

    The judgement process can be based on importance, preference, or likelihood. Expert Choice™ provides four types of comparison modes: verbal, numeric, graphical, and questionnaire. Data can be directly entered into the model. The verbal mode allows the user to pair-wise compare the elements on a nine-level scale with levels ranging from "equal" to "extreme". The decision-maker represent the preference in matrix mode with "A" preferred over "B" and in graphical mode by adjusting a bar chart. Through the pair-wise comparison process, Expert Choice™ derives the priorities and combines all the priorities to arrive at an overall ranking of the alternatives. In addition, sensitivity analysis can be performed to determine how changes to one or more judgement weights affect the final priorities.

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[36] Expert Choice™ Tutorial Version 9.0, Expert Choice Decision Support Software, Pittsburgh, PA 1995, pp. ii

4.3   GROUP DECISION MAKING

Often, important decisions today are not made by a single individual but by groups of people such as technical experts, organization managers, or stakeholders. This is certainly the case in the development of complex initiatives like those AMEDD must address. TeamEC for Windows[TM] is a decision-support software tool designed specifically to help groups enhance the quality of their decisions by bringing structure to their decision making process[37]. Based on the Analytic Hierarchy Process (AHP) decision-making methodology, TeamEC helps group members define the objectives, goals, criteria and alternatives and then organize them into a hierarchical structure. Using hand-held radio keypads for voting, participants compare and prioritize the relative importance of the decision variables. TeamEC then synthesizes the groups' judgments to arrive at a conclusion and allows you to examine how changing the weighting of the criteria affects the outcome.

Appendix C shows an excerpt from Kirti Srisoepardani's Ph.D. dissertation comparing the various group decision-making methods. AHP is a structuring and measuring method and rates high to very high in all except one category (scope of problem abstraction). The methods evaluated in this excerpt include:

<u>Structuring</u>	<u>Order and Ranking</u>
Analogy, Association	Voting
Boundary Examination	Nominal Group Techniques
Brainstorming/Brainwriting	Delphi
Morphological Connection	Disjointed Incrementalism
Why-What's Stopping	Matrix Evaluation
	Goal Programming
<u>Structuring and Measuring</u>	Conjoint Analysis
Bayseian Analysis	Outranking
MAUT/MAVT	
AHP	

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[37] http://www.expertchoice.com/

5. AMEDD'S TELEMEDICINE INTIATIVES AND THE ANALYTICAL HIERARCHY PROCESS (AHP) IN PRACTICE

5.1 EVALUATION AND CHOICE (EC) MODEL CONFIGURATION

5.1.1 LEVEL I: GOAL

Since the purpose of the study is to analyze and prioritize current AMEDD and AMEDD-led telemedicine initiatives, the goal of the health technology assessment tool may be stated as:

- GOAL: Allocate resources to telemedicine initiatives (or projects)

5.1.2 LEVEL II: OBJECTIVES

The second level of the AHP model is the statement and weighting of the objectives. The key objectives for allocation of telemedicine resources given by the Telemedicine Board of Directors (TBOD) are:

- Achieving specific telemedicine initiative project objectives

- Keeping active duty forces on the job and taking healthcare to the field

- Enhancing and measuring the health and fitness of the force

- Modifying the total Military Health Services System staffing model to reduce the size and skill mix requirement for support of military operations

- Increasing the efficiency of the MHSS staff in peacetime, maintaining military readiness skills of the MHSS active duty staff, and reducing the health service requirements of TRICARE contractors.

The first type of model is the evaluation and choice (EC) model to assist decisions-makers in the allocation of resources to each of the above objectives.

5.1.3 LEVEL III: (SUB) OBJECTIVES

After market analysis, literature review and brainstorming, the REL team developed a preliminary list of (sub) objectives that are important in telemedicine resource allocation. The objectives and brief description of each are listed below. The (sub) objectives are divided into three categories: benefit, cost, and risks. In

addition, the (sub) objectives are further divided into three areas: technical, business, delivery of care (care).

5.2   BENEFIT OBJECTIVES

5.2.1   TECHNICAL OBJECTIVES

- Compatibility (COMPATIBL) – Compatibility of system with existing information systems

- Multiple Usage (MULT_USE) – Multiple uses of the same equipment

- Reliability (RELIABLE) – Reliability of the system

- Performance (PERFORM) – Performance level of the system

- Standards (STANDRDS) – Meeting the established standards (transmission, records, etc.) such as HL7, DICOM, TCP/IP, H32X, etc.

- Speed (SPEED) – Speed of transmission (available bandwidth)

- Upgrade (UPGRADE) – Ease of system upgrades

5.2.2   BUSINESS OBJECTIVES

- Ease of Use (EASE USE) – Ease of use of the system

- Integration (INTEGRTE) – Integration with existing IM/IS infrastructure

- Market penetration (MARKETP) – Market penetration (use of technology/total number of uses)

- Measures of Performance (MOP) – Does the initiatives have clearly written measures of performance?

- Patient (PATIENT) – Primary patient population

- Political (POLITICAL) – The political support for the initiative

- Plan (PLAN) – Does the initiative have a written business or project management plan?

- Usage Level (USGE_LVL) – The level of system usage

5.2.3 DELIVER OF CARE (CARE) OBJECTIVES

- Approvals (APPROVL) – Approval of system by review board(s) and/or FDA

- Efficiency (EFFICNCY) – Efficiency in the delivery of care

- Quality (QUALITY) – Quality of care

- Safety (SAFETY) – Safety of equipment/procedure

- Satisfaction (SATISF) – Patient (or student) satisfaction level with procedure/system/technology

- Security (SECURE) – Patient privacy, information security and confidentiality

5.3 COST OBJECTIVES

5.3.1 TECHNICAL OBJECTIVES

- Maintenance (MAINTAIN) – Maintenance requirements of the system

- Size (SIZE) – Size of the equipment

- Weight (WEIGHT) – Weight of the equipment

- Assembly (ASSEMBLY) – Level of difficulty in assembling the equipment

- Customization (CUSTOM) – Customization level of the equipment

5.3.2 BUSINESS OBJECTIVES

- Initial Capital Requirements (ICAPITAL) – Initial capital investments

- On-going Capital Requirements (OCAPITAL) – On-going monthly capital investments

- Training (TRAINING) – Initial system training requirements

- Facility (FACILITY) – Facility requirements

- Scheduling (SCHEDUL) – Scheduling requirements

- Transmission Cost (TRANS$) – Monthly transmission costs

5.3.3 DELIVERY OF CARE (CARE) OBJECTIVES

- Clinician Inconveniences (C_INCONV) – Level of clinician inconvenience

- Confinement (CONFINE) – Patient confinement requirement (in room, in machine, etc.)

- Patient Delays (DELAY) – Patient delays before, during, or after the TMED session

- Patient Discomfort (DISCMFT) – Level of patient discomfort

- Patient Inconveniences (P_INCONV) – Level of patient inconvenience

- Patient Movement (MOVEMNT) – Required patient movement

5.4 RISK OBJECTIVES

- Technical (TECH_RK) – The failure to develop or procure any element, component, end-item, or subsystem

- Cost (COST_RK) – Any variation in predicted costs that exceeds an acceptable level

- Schedule Risk (SCHED_RK) – Failure to meet any program milestone and/or complete any major event within an acceptable time

5.5   LEVEL IV: ALLOCATION OF RESOURCES AMONG ALTERNATIVES

The next level will assist decision-makers with allocating the proportion of available resources to following three types of telemedicine projects, or alternatives:

- Video Teleconferencing (VTC) – Video Teleconferencing applications are real-time applications that do not involve direct patient care. Applications include continuing education and administrative meetings.

- Real-Time Telemedicine – Real-Time telemedicine applications involve interactive audio-visual consultations between medical providers and patients using high-resolution monitors, cameras, and electronic medical instrumentation, etc. and involves patient care.

- Store-and-Forward Telemedicine – Store-and-Forward Telemedicine applications involve the exchange of data and image information on a delayed basis.

Figure 4 shows the EC Model configuration. Note: All models start with equal weights for all objectives, (sub) objectives, and alternatives. The final weights are obtained and verified during the data collection process.
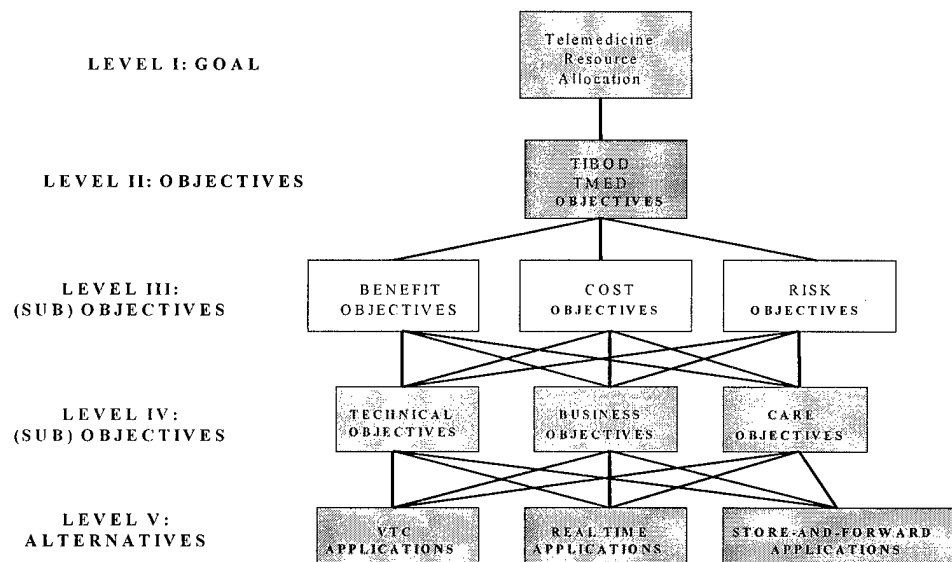
Figure 4 Telemedicine E&C Model
(which shows the basic EC model hierarchy)

5.6 PRELIMINARY EC (PRIOR TO DATA COLLECTION) MODELS

5.6.1 Figure 5 shows Level I and II of the preliminary EC Benefits model
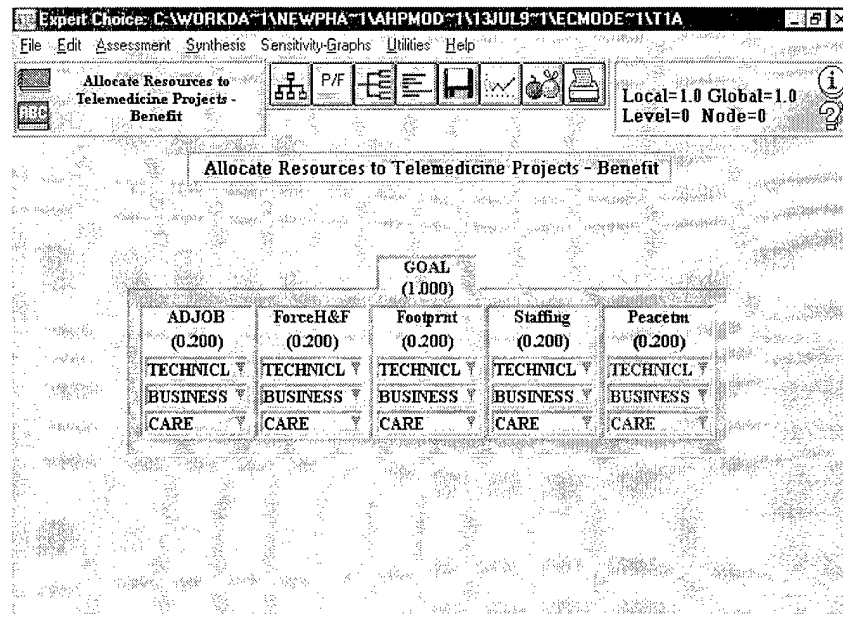
Figure 5 Preliminary EC Benefit Model Level I & II
(which shows Level I-Goal and II-Objectives of the EC Benefit Model)

5.6.2 Figure 6 shows Level II and III of the preliminary EC Benefits model
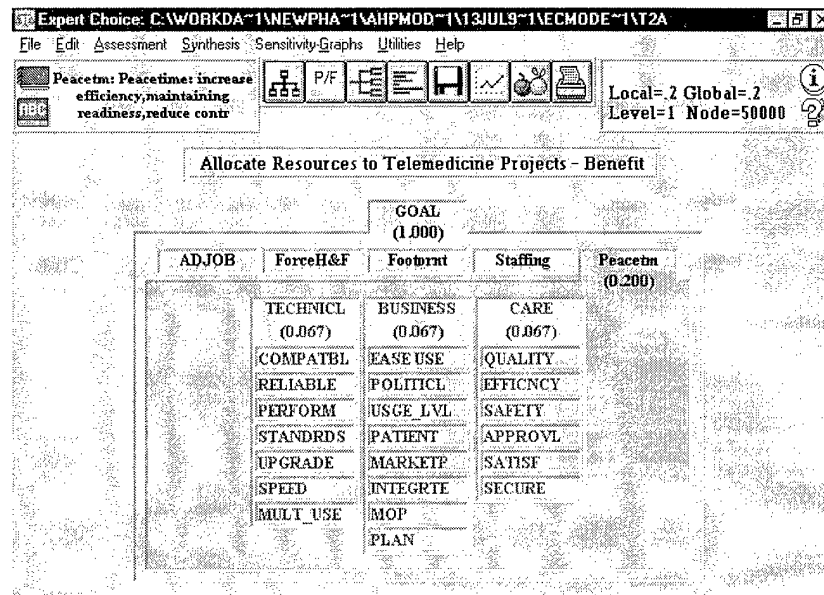
Figure 6 Preliminary EC Benefit Model Level II and III
(which shows Level II-Objectives and III-(sub) Objectives of the
EC Benefit Model)

5.6.3   Figure 7 shows Level I and II of the preliminary EC Cost Model
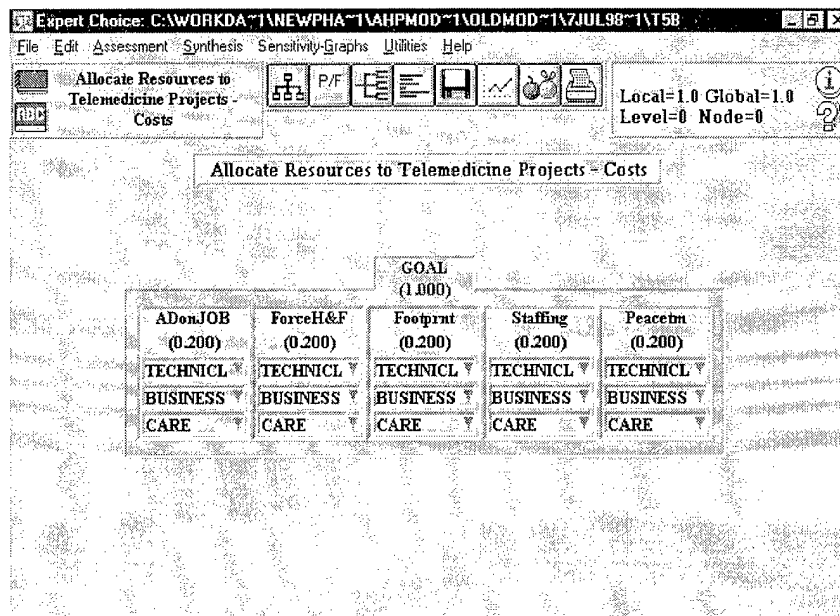
Figure 7 Preliminary EC Cost Model Level I and II
(which shows Level I-goal and II-Objectives of the EC Cost Model)

5.6.4   Figure 8 shows Level II and III of the preliminary EC Cost Model
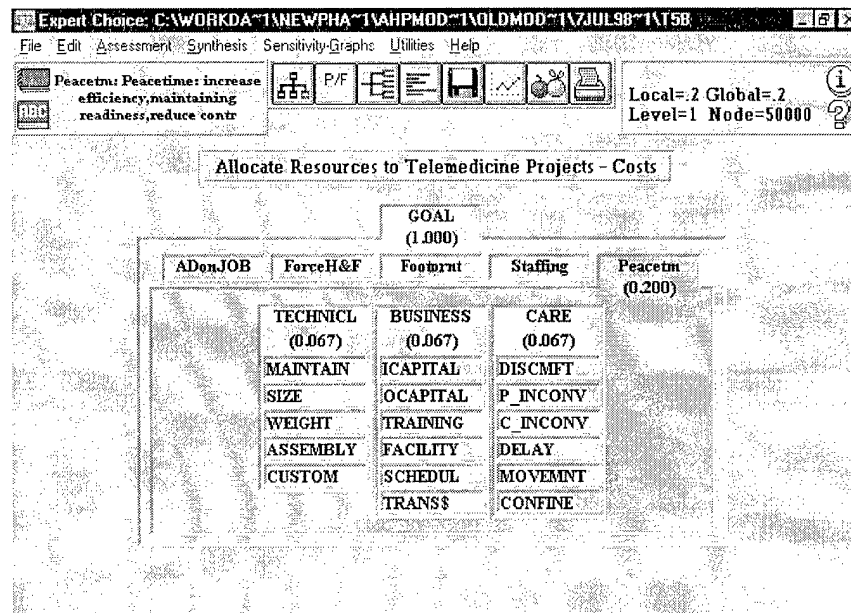
Figure 8 Preliminary EC Cost Model at Level II and III
(which shows Level II-Objectives and II-(sub) Objectives of the EC Cost Model)

5.6.5 Figure 9 shows Level I and II of the preliminary EC Risk Model
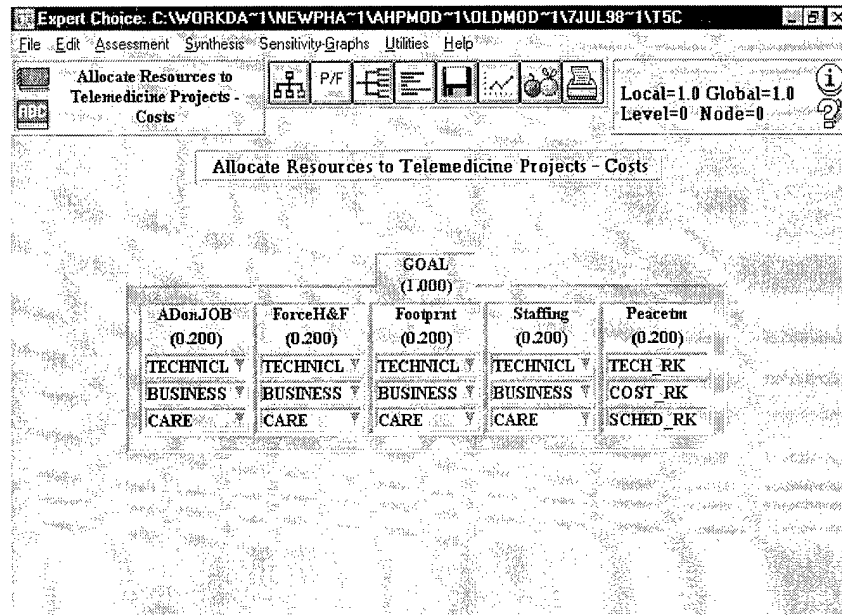
Figure 9 Preliminary EC Risk Model Level I and II
(which shows Level I-Goal and II-Objectives of the EC Risk Model)

5.6.6 Figure 10 shows Level II and III of the preliminary EC Risk model
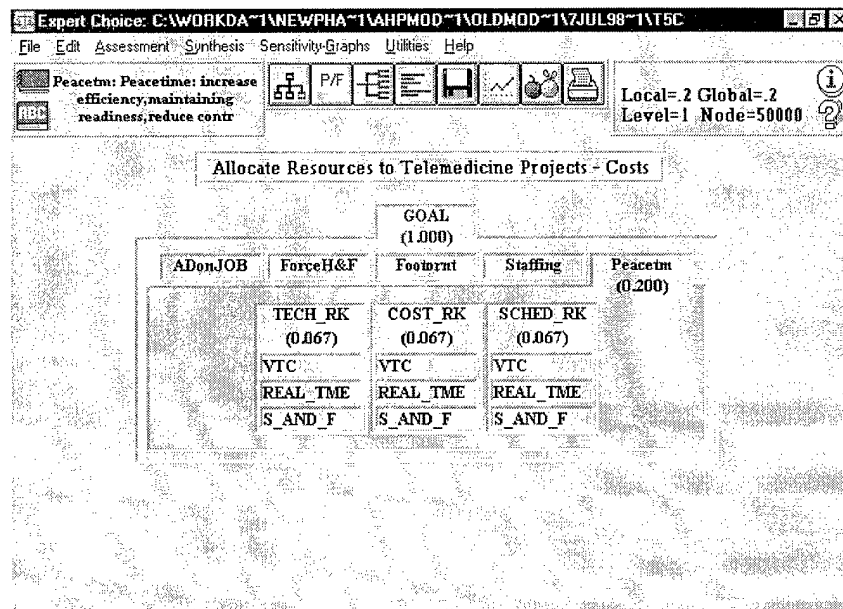
Figure 10 Preliminary EC Risk Model Level II and III
(which shows Level II-Objectives and III-(sub) Objectives for the EC
Risk Model)

After data collection, the resulting proportional weights can be used in evaluations such as:

- Cost-Benefit Analysis where $f = \dfrac{\text{Benefit}}{\text{Cost}}$
  or

- Cost-Benefit-Risk analysis where $f = \dfrac{\text{Benefit}}{\text{Cost} * \text{Risk}}$
  or

- Optimization of Benefits

5.7 THE RATINGS MODEL

The previous evaluation and choice (EC) model is a method used to determine the initial amounts that should be allocated to the three types of projects: VTC, Real-Time and Store-and-Forward telemedicine. The ratings approach is useful to further indicate how to allocate resources within a given type of project to individual initiative. The objectives are the same, however, we need to define intensities that describe objectives at the lowest level of the hierarchies.

The preliminary intensity levels have been defined for all objectives at the lowest level. These levels were determined by pair-wise comparison of intensity in terms of the next higher level objective. The intensity levels may either qualitative or quantitative judgement levels. For example, the technical objective of "compatibility with existing information systems" may be defined in four qualitative intensity levels:

VERBAL MODE PAIR-WISE COMPARISON
- Highly Compatible is equally to moderately more preferable than More Compatible

- Highly Compatible is moderately more preferable than Barely Compatible

- Highly Compatible is strongly more preferable than Not Compatible

- Moderately Compatible is equally to moderately more preferable than Barely Compatible

- Moderately Compatible is moderately more preferable than Not Compatible

- Barely Compatible is equally to moderately more preferable than Not Compatible

The resulting local intensity levels are:

INTENSITY LEVEL (Compatibility Objective)	Local Weight
Highly Compatible (H_Compat)	0.483
Moderately Compatible (M_Compat)	0.272
Barely Compatible (M_Compat)	0.157
Not Compatible (N_Compat)	0.088

An interpretation of the above local weight values is that "highly compatible" is the most preferable followed by "moderately" and "barely compatible". "Not compatible" is the least preferred. In addition, "highly compatible" is approximately 3.1 times more preferable than "barely compatible" and 5.5 times more preferable than "not compatible". The above weights are the local weights, which reflect the intensities with respect to the lowest level objective, "compatibility".

A summary of the preliminary local weights for the objectives used in the assessment tool are described in detail in Appendix E.

The "global" weights are the weight of the factor with respect to the goal and are derived by a process of priority setting. The task of priority setting requires that the objectives, (sub) objectives, and the alternatives themselves be gradually layered in the hierarchy so that the elements in each level are compared among themselves in relation to the elements of the next higher level. Now the priorities are set for the elements in each level several times – once with respect to each objective in the next higher level. These in turn are prioritized with respect to the elements in the next higher level and so on. This is done by coming down the hierarchy and weighting the priorities measured in a level with respect to a criterion in the higher level by multiplying by the weight of that criterion. The weighted priorities can then be added for each element in the level to obtain its overall or global priority[38]. The global priorities for the assessment tool will be synthesized after the collection of relevant data.

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[38] Saaty, Thomas L. , Fundamentals of Decision Making and Priority Theory with The Analytic Hierarchy Process, pp. 11.

6. DATA COLLECTION

6.1 TECHNOLOGY PROFILE - DATA COLLECTION INSTRUMENT

The purpose of the Technology Profile is to gather relevant, in-depth information about the individual telemedicine initiatives and serves as a starting point for discussions of 1) what technologies are currently implemented, 2) what selection decisions (judgements) were made prior implementation of these initiatives, and 3) what future initiatives were being investigated . Figure 11 shows the 4-step development process for the Technology Profile. The Technology Profile involved the identification of relevant technologies, conducting pre-briefing, interviews, site visits, and following-up work as necessary.
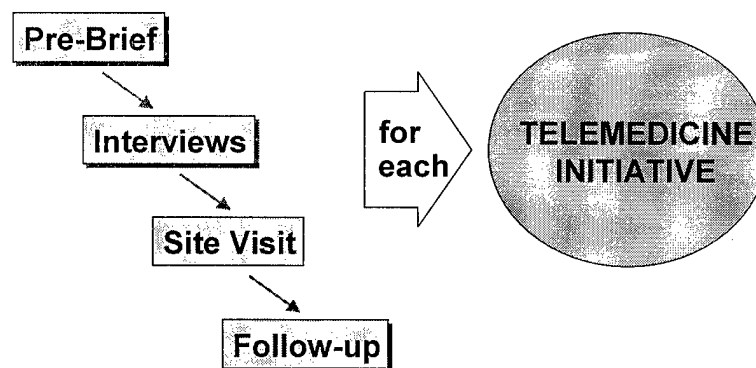
Figure 11 4-Steps in the Development of the Technology Profile
(which shows the requirements for on-site data collection)

REL presented the first draft of the Technology Profile during the 4 DEC 98 In-Progress Report (IPR). See Appendix F for reference. A second version of the Technology Profile was developed and piloted in TRICARE Region 6 after the incorporating input from AMEDD. See Appendix G for a copy of the 2nd draft of the Technology Profile.

6.2 BACKGROUND INFORMATION

With the help of GPRMC, three telemedicine sites were identified for assessment: Brooke Army Medical Center (BAMC) at Fort Sam Houston, Texas; Darnall Army Community Hospital (DACH) at Fort Hood, Texas; and Bayne-Jones Army Community Hospital (BJACH) at Fort Polk, Louisiana.   Over the course of three months, all three sites were visited and interviews were conducted with members of the clinical, technical and management teams. A chronology of site visits and points of contact for the project are shown in Appendix H.

CHALLENGES TO MODEL DEVELOPMENT

After review of preliminary data, REL determined that a majority of the projects used BAMC as the telemedicine infrastructure hub, consistent with BG Claypool's 'Hospital Without Walls' concept for telemedicine. BAMC served as the telemedicine hub while DACH and BJACH served as the spokes for the majority of the telemedicine efforts. However, some projects such as the DACH telepathology project typically uses the Armed Forces Institute of Pathology (AFIP) as the hub, not BAMC.

One difficulty REL encountered in gathering data for the Technology Profile was the fact that the telemedicine equipment (NEC) had not been used in normal operations for a long period of time. According to some users, the equipment may not have been operational for as long as over a year. Therefore, it was difficult to assess the usefulness of the system. Several attempts have been made by contracted vendors, working along side government and military personnel to solve the numerous technical problems. At the time of this report, the telemedicine systems were not operational and may be placed back into normal operations at an unspecified date sometime later this year.

In addition, REL found it extremely difficult to assess the effectiveness of the telemedicine initiative due to the lack of data associated with the 31 initiatives examined. Quantitative data as well as qualitative data was not available. Since data collection is not a part of the regular business process at the user level, relevant data is only available when extra effort was made in its collection. None of the sites had a regular method of data collection for telemedicine and no standard identifying required, uniform data sets have been specified nor the resource requirements for data collection quantified or appropriated. Until the commission of the Virginia Tech study by the AMEDD Board through Vector Research[39], which is still on-going, telemedicine sessions were not regularly recorded as such on any form. In fact, DACH was the only location where telemedicine and VTC usage data was collected and supplied for this study. The period of collection was from July to September 1997 for telemedicine and July to December 1997 for VTC. The lack of data problem was encountered at all three TRICARE Region 6 sites and affected greatly REL's ability to analyze the AMEDD initiatives.

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[39] Special thanks to Professor Sigrid Gustafson of Virginia Tech

6.2.1 BACKGROUND INFORMATION - DOD HEALTH SERVICES REGION 6 (TRICARE SOUTHWEST)

T R I C A R E
S o u t h w e s t

One of the major initiatives in the TRICARE Southwest Region is the TRICARE Southwest National Telemedicine Network. The use of the term 'telemedicine' was broadened to include care provided through telecommunications technology in the form of systems such as teleconsulting, teleradiology, and telepathology. This network is a video teleconferencing based system[40]. See Appendix H for the TRICARE Southwest Brochure.

TRICARE Southwest received $4,500,000 from Department of Defense (DOD) to finance work in telemedicine. The TRICARE Southwest telemedicine projects involved 34 facilities and clinical services such as: nursing, general medicine, primary care, and general surgery. Twenty-four specialty services were also provided. See Appendix I for additional information such as the abstract summary and comprehensive summary of the primary/participating organization, networks, projects, and facilities data. The data summary also included information for BAMC, DACH, and BJACH.

Some specific applications of the TRICARE Southwest National Telemedicine Network included 1) a remotely controlled examination camera which had a powerful zoom-focus capability which allows a dermatologist to examine small details of a patient's skin; 2) an electronic stethoscope, in conjunction with real-time digital transmission of an EKG and echocardiogram, permitted a cardiologist to do a complete cardiology examination; 3) specific camera adapters and resolution capabilities enhanced by remote-controlled optics provided an ophthalmologist a clear view of the retina of a patient at the referring site; 4) a pathologist using the telemicroscopic adapter examined a frozen section or bone marrow slide, and 5) a document camera provided with the teleradiology system allowed consulting physicians to review x-ray films.

The TRICARE Southwest National Telemedicine Network was approved by the DOD Military Health Services System (MHSS) Proponent Committee. The four stated benefits of this telemedicine project were[41]:

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[40] http://www.tricaresw.whmc.af.mil/brochure.html, TRICARE Southwest Brochure. pp. 1
[41] TRICARE Southwest Brochure, pp. 2

- Increased Access
  - Telemedicine will improve beneficiary access to referrals
- Increased beneficiary and provider satisfaction
  - Both beneficiary and provider satisfaction will increase due to less traveling for the patient to a specialist or the specialist to a remote site.
  - The family practice physician will maintain control of the patient and thus gain knowledge of more complex medical problems and improve continuity of care.
- Preparation for deployment
  - The providers will prepare for support of deployed forces via teleconsulting
- The program will be cost-effective.
- The telemedicine program will integrate the regional referral process and facilitate cross-service referrals.

It was estimated that the system could avoid over $1 million in cost annually from reduction in travel and CHAMPUS costs throughout the remote locations in Region 6, a real potential exist for a payback within three years[42].

Another Region 6 Lead Agent telemedicine effort is the "TRICARE Southwest Managed Care University." This video teleconferencing network (VTCN), or "virtual" university, provides continuing executive skills education for MTFs in the region via VTCN. The course material relies heavily on those already available or under development from existing Air Force, Navy, Army and Uniformed Services University of the Health Sciences sources. Additional course material is provided by sources in industry and academia, such as the U.S. Army-Baylor Graduate Program in Health Care Administration, Ft. Sam Houston, San Antonio, Texas; and the School of Health Care Sciences, Sheppard AFB, Wichita Falls, Texas.

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[42] TRICARE Southwest Brochure, pp. 2-3

6.2.2 BACKGROUND INFORMATION - GREAT PLAINS REGIONAL MEDICAL COMMAND (GPRMC TELEMEDICINE)
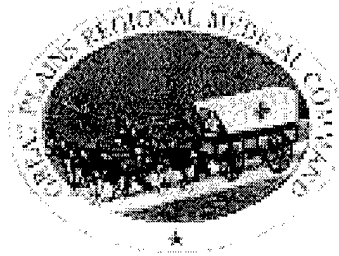
The seven Regional Medical Commands (RMCs) were a key part of the AMEDD restructuring to allocate resources and oversee the day-to-day operations in the medical treatment facilities (MTFs) while the U. S. Army Medical Command (MEDCOM) headquarters provided strategic vision and guidance. The Great Plains Regional Medical Command (GPRMC) is a U. S. Army Command that included 10 U. S. Army facilities located within 6 states. TRICARE Region 6 is situated within the geographical boundaries of GPRMC. Figure 12 shows the overlap of these organizations. All three Region 6 sites examined by REL, BAMC, DACH, and BJACH were located within the GPRMC boundaries.

BG Harold L. Timboe currently commands GPRMC as well as Brooke Army Medical Center (BAMC).
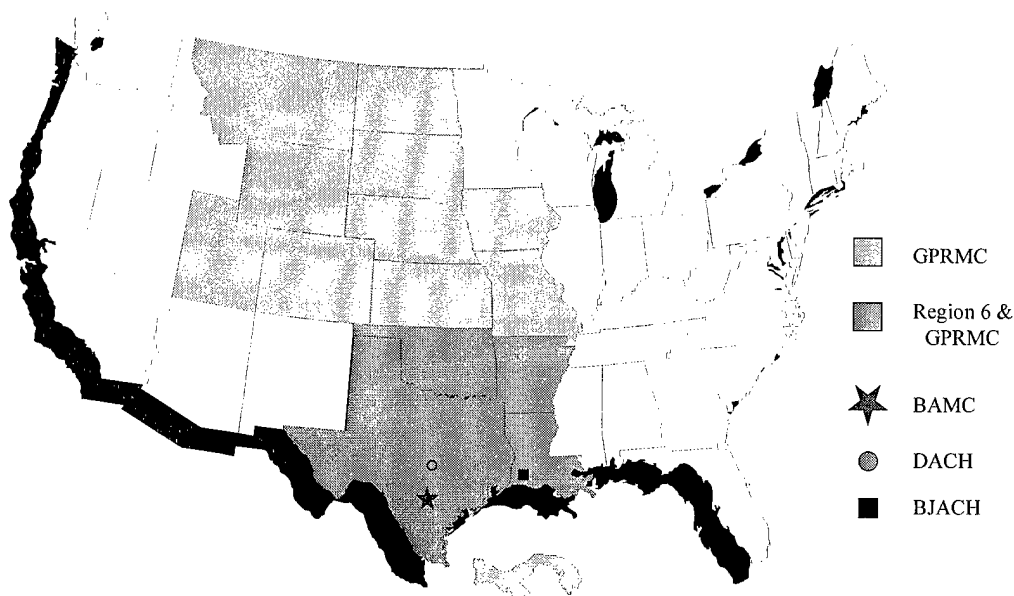
Figure 12 TRICARE SOUTHWEST (Region 6), GPRMC, and BAMC, DACH, BJACH
(which shows the overlap of the sites, RMCs and TRICCARE Regions)

6.2.2.1 Telemedicine System Funding

The initial purchase for telemedicine system at BAMC/GPRMC dates back to 28 June 1995. No tracking system is in place to account for the telemedicine and Video Teleconference (VTC) equipment costs, installation, upgrades, and maintenance. An extensive internal review of telemedicine/VTC equipment and equipment costs was conducted by a BAMC Auditor for Internal Review & Audit Compliance Office as indicated by a draft report dated 15 January 1998. It was determined that approximately $6M may have been expended towards telemedicine and VTC systems during the period between December 1995 and December 1997. However, the $6M figure may only be a gross estimate due to the following factors:

- The estimate included only BAMC and HQ, GPRMC transactions because they were both under BAMC property accountability.

- Some of the transactions showed that HQ, GPRMC purchased telemedicine and VTC communications equipment for other MTFs in the region.

- Some systems located at the BAMC warehouse since 1995 have been opened and components were missing.

- Some equipment was missing during an inventory and others are listed improperly.

- The telecommunication costs (such as leased lines) were not included.

- Some telemedicine systems shipped to BJACH remain unopened and have not been inventoried.

- The telemedicine and VTC cost at DACH and BJACH were not available.

A draft copy of the memorandum for the Chairman of the telemedicine/VTC Working group along with the supporting cost documentation are included in Appendix K. This was a working draft collected at REL's site visit on 9 February 1998. REL has requested the final memorandum but has not received it to date. Therefore, only the draft copy is included in this report.

One of the goals of the Technology Profile was to gather not only technical but also financial cost data including the initial purchase, maintenance, and subsequent upgrades in order to assess the entire telemedicine project assessment. Unfortunately, financial data along with usage data was not available and was difficult to obtain. Therefore, REL was unable to get a better cost estimate than the rough order of magnitude (ROM) of $6M associated with initiatives within GPRMC. It would be very difficult to distribute the project cost associated with each initiative due to a lack of precise and complete accounting records.
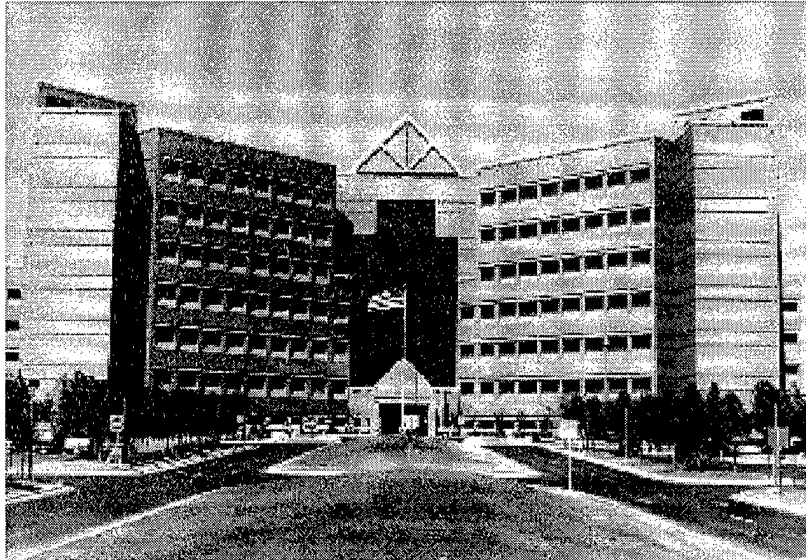
6.3   BROOKE ARMY MEDICAL CENTER TELEMDICINE

Brooke Army Medical Center (BAMC) is a modern state-of-the-art health care facility located at Fort Sam Houston, Texas with the capability of providing Level I trauma support and graduate education. BAMC's $253 million project replaced most of BAMC's old 1938 facilities and now provides care in a new 450-bed, 1.5-million-square-foot facility. Along with Wilford Hall Medical Center, the regional TRICARE lead agent, BAMC and WHMC serves approximately 185,000 beneficiaries. On 14 March 1996, BAMC was officially dedicated and on 13 April 1996, BAMC was open for business[43].

BAMC's telemedicine projects were almost synonymous with those of GPRMC and TRICARE Region 6 telemedicine projects. The reason was that BAMC also served as the headquarters for GPRMC and utilized funds from both GPRMC and TRICARE Region 6.

The GPRMC Telemedicine/VTC Working group began in July 1997 and met on a monthly basis. It is a forum to share information, address and coordinate among the various system stakeholders. The working group has convened at least seven meetings to date. Some issues the group addressed during past meetings included: reporting procedures to the DOD Medical Network Service Center for network problems; identification of help, scheduling, and training functions at BAMC; comprehensive equipment inventory and cost; addressing departmental telemedicine and VTC needs. Notes from the second to the seventh meeting are shown in Appendix L.

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[43] Brooke Army Medical Center works in New State-of-art Facility, The Mercury, Public Affairs Office, HQ MEDCOM, Fort Sam Houston Texas. Fall 1996, pp. 14

Since data collection is not a regular output of the Telemedicine/VTC business process, it was difficult to estimate the usage levels of the various systems. Telemedicine and VTC data were not actively collected by BAMC personnel on a regular basis. Therefore, the lack of utilization data is apparent in the BAMC Technology Profile shown in Appendix M.

Although utilization data was not available from BAMC, other data such as configuration and connectivity data were collected. From these alternate sources, the following telemedicine and VTC activities were inferred and summarized in Table 2. Data such as the frequency of use, duration of session, final outcome data were not available.

Dept	Description	App.	Department
Medicine	Grand Rounds/CME to MEDDACS	VTC	Department of Medicine
	RRC requirements/distance learning	VTC	DOM Residents at DACH<->BAMC
	Continuity Clinic	T-Med	DOM Residents at DACH<->BAMC
	Gastroenteroscopy	T-Med	GI Svc
	Echocardiography	T-Med	Cardiology Svc
Clinical Invest.	Research Ethics Course	VTC	DCI
	Institutional Review Board Mtgs	VTC	DCI
Preventive Med.	Preventive Medicine Conferences	VTC	Preventive Medicine
Radiology	BAMC <->DACH radiology	T-Med	Department of Radiology
	Resident teaching WHMC<->BAMC	VTC	Department of Radiology
	Teleradiology throughout GPRMC	T-Med	Department of Radiology
Dermatology	Teledermatology DACH <-> BAMC (Research)	T-Med	Department of Dermatology
Pediatrics	subspecialty peds Clinics	T-Med	DACH to 8c WH peds sub clinic
	NICU level 2 to NICU level 3	T-Med	DACH NICU to San Antonio NICU WH
	Resident continuity clinics	T-Med	DACH to 8c WH peds sub clinic
	Resident teaching conf	VTC	WH to DACH to BAMC clinic
Surgery	(On Loan) Neurosurgery Conference Room	VTC	Neurosurgery Conf. Rm.
	Ft Carson <-> BAMC	T-Med	Urology
	Ft Riley <-> BAMC	T-Med	Urology
	Ophthalmologic consultations	T-Med	Ophthalmology
	Otolaryngologic consultations	T-Med	ENT
Pathology	Telelpathology DACH<-> BAMC <->AFIP	T-Med	Anatomic Pathology
Psychology	Consultaltions BAMC <-> Ft Polk	T-Med	Psychology
Dental	Teledentistry BAMC <-> GPRMC	T-Med	Dental Clinic
Health Promo.	Health promotion education BAMC<->GPRMC	VTC	HPC Classroom
T-Med Suite	VTC / Consults	VTC	Any
	TelMed / Consults	T-Med	Any
Nursing Ed.	VTC / Distance Learning	VTC	NESD Classroom

Table 2 BAMC Telemedicine /VTC Activity
(which shows the types of Telemedicine/VTC activities at BAMC)

Each of the following projects was identified as a separate initiative for analysis using the health technology assessment tool. Table 3 showed the various telemedicine and VTC activities between BAMC and other MTFs in GPRMC. Again, usage level data was not available for any of these activities.

ACTIVITY	PRIME POC
FT SILL, OK	
Emergency Dept., RACH	MAJ Kevin Hammond, MC
FT HOOD, TX	
Dept. of Medicine/Neurology, DACH	MAJ Erik Kobylarz, MC
Pediatrics, DACH	COL Marshall Dressel, MC
OB/GYN, DACH	MAJ Susan Dunlow, MC
Dept. of Ambulatory Care, DACH	MAJ Ronald King, MC
Otolaryngology, DACH	MAJ Heidi Close, MC
Dept. of Surgery, DACH	LTC James Leech, MC
Emergency Dept., DACH	MAJ Albert Villarin, MC
Dept of Medicine, Tremmier Clinic	CPT Howser, MC
Emergency Dept., DACH	LTC Clyde Turner
Emergency Dept., DACH	1LT Frey, Admin Officer
IMO, DACH	Mr. Ed Pitt
T-MED project officer, DACH	MAJ Robert Newhouse
FT CARSON, CO	
Emergency Dept., RACH	MAJ Michael Bowen, MC
FT POLK, LA	
Emergency Dept., BJACH	CPT Erwina Ungos, MC
FT RILEY, KS	
Emergency Dept.,	CPT Jeff Hartman, MC
Urology Svc.,	CPT Patricia Crane, MC
T-MED project officer, Irwin ACH	1LT Joseph Keizer
	Micheline Fields, IMO
FT LEAVENWORTH, KS	
FT LEONARD WOOD, MO	
POC only	Connie Lubina
MEDEL, SOTO CANO, HONDURAS	
Medical Group Command	COL Gail M. Johnson, MC
Joint Task Force Bravo	CPT Neri, LOG & T-Med Project Officer

Table 3   BAMC Telemedicine/VTC Activity with GPRMC MTFs
(which shows Telemedicine POCs for GPRMC)

6.4   DARNALL ARMY COMMUNITY HOSPITAL TELEMDICINE

Darnall Army Community Hospital (DACH) with 264 beds serves Fort Hood, one of the world's largest military posts and home to III Corps, 1st Calvary Division and 4th Infantry Division. Darnall Army Community Hospital is currently commanded by COL Kenneth L. Farmer Jr., MC. Darnall's 40-mile catchment area includes Gatesville to the North, Temple to the East, Georgetown to the South and Lampasas to the West. The demographics of the catchment area includes 141,000 DOD beneficiaries with 30% Active duty, 38% ADFM, 28% RET&FM, and 4% Medicare patient population[44]. Five clinics outside of DACH are operated by Darnall and are considered Primary Care Managers under the TRICARE prime option. These clinics include:

CLINIC	LOCATION
4th ID TMC – Bennett Health Clinic	31st Street & Battalion Ave., Ft. Hood
Monroe TMC	31st Street & Battalion Ave., Ft. Hood
Adult Chronic Care (AC3) Clinic	2900 S. Trimmier Road, Killeen, TX
Family Care Clinic	2201 South W.S. Young Plaza, Killeen, TX
Family Care Clinic	819 East Highway 190, Copperas Cove, TX

Table 4 Darnall Operated Clinics
(which shows the locations of the DACH Clinics)

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[44] Farmer, K., Command Brief, oral presentation, December 1997

With 41,725 Active-Duty soldiers and 136,000 enrollment eligible, a typical day at DACH may be characterized by:

DESCRIPTION	NUMBER
CLNIC VISITS	2,223
3 Family Care Clinics	382
DACH Specialty Clinics	1,256
Troop Medical Clinics	456 * Does not include BAS visits
Emergency Room Visits	129
Admissions	34
Beds Occupied	88
Live Births	8.3
Surgical cases (Same-Day & Major)	13
Meals Served	1,070
Prescriptions Filled	3,300
Laboratory Tests	1,328

Table 5 Typical Day at DACH (OCT 96 – JUN 97)
Average daily number computed using a 7-day week
(which shows the types and levels of medical activity at DACH)

The top 6 DRGs at DACH during the period FY 97 (1 OCT 96 to 30 SEP 97) include: Vaginal deliver without complications (1940 cases), Normal Newborn (1858 Cases), Neonate with significant problems (675 cases), Bronchitis and Asthma (242 Cases), Vaginal deliveries with complications (233 cases), and Neonate with minor to moderate problems (180 cases).

Army Graduate Medical Education(GME) is conducted in all MEDCENs and some MEDDACs. Current Darnall GME training programs are shown in Table 6. In addition to Army GMEs, DACH participated in a partnership for Texas which includes Texas A&M university Health Science Center (College of Medicine), Scott & White Memorial Hospital and Clinic, Driscoll Children's Community Hospital and Department of Veterans Affairs Central Texas Health Care System.

DARNALL GME	
- Emergency Medicine Residency Program	
COMBINED GME PROGRAMS	
- OB/GYN	BAMC/WHAFMC
- Pediatrics	BAMC/WHAFMC
- Medicine	BAMC
AFFILIATED GME PROGRAMS	
- Family Practice	UNTHSC
- FM (Psychiatry, Dermatology, Pediatrics, OB, Orthopedics)	Scot & White Memorial Hospital and Clinic
- Podiatry	VA Waci
- Surgery	WHAFMC
- Pediatrics	Keesler AFB
- EM (OB, Dermatology, Radiology)	BAMC
- Medical Students	USUHS & Nationwide
- Health Care Administration	Baylor

Table 6 DACH GME Program
(which shows the GME programs at DACH)

The clinical staff at Darnall has expressed the need for both the dial-anywhere and store-and-forward telemedicine capabilities. The following sections describe the telemedicine configuration between DACH and BAMC prior to the move to the new BAMC and the current configuration. A brief description of the provided service, current issues, and future plans is also included.

DACH has developed both a Business Plan and Standard operating Procedures for Telemedicine. These documents are included in Appendix N and O for reference. The business plan shows the implementation BG Claypool's "Hospital Without Walls" concept. DACH's intent was to leverage technology in order to reduce the already taxed MEDDACs with the growing beneficiary population due to the Army' execution of the Base Realignment and Closure Act (BRAC). This Business Plan can be expanded to address business areas such as the market analysis and competitive analysis, as well as financial overview such as financial history, financial needs, and breakeven analysis. These elements would generally be covered in a complete private sector business plan.

Prior to the move to the new BAMC, Mr. Ed Pitt, Chief, Telecommunications collected the only existing telemedicine usage data. DACH usage data was separated into two categories, telemedicine and video teleconference. The data is shown in Figures 13, 14 and 15. Unfortunately, with the move to new BAMC combined with the upgrade to dial-anywhere capability and the associated technical difficulties, telemedicine usage data after 25 SEP 96 and Video teleconference data after 31 DEC 96 are not available.

Although many departments at DACH express a variety of telemedicine usage's, the widespread of telemedicine has not been realized. Some sample documentation of these requests is included in Appendix P. The REL Technology Profile for DACH is included in Appendix Q.

VIDEO TELECONFERENCING
JULY 1 THRU 25 SEP 1996

	JULY	AUG	SEP
NICU	0	0	0
DERM	32	30	23
INT MED	3	4	0
AC-3	3	4	16

IN HOURS BY MONTH
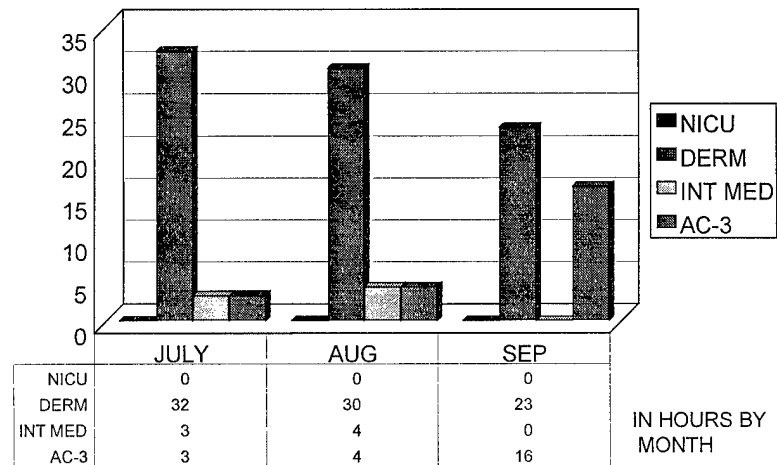
Figure 13 Video Teleconference Usage for 4th Quarter FY 96
(which shows a declining usage level)

VIDEO TELECONFERENCING
4TH QUARTER OCT - DEC

	OCT	NOV	DEC
NICU	1	0	0
DERM	7	12	8
INT MED	0	0	0
AC-3	5	8	6
PICTEL	6	12	5
REGION VI	2	8	6

IN HOURS OF USE
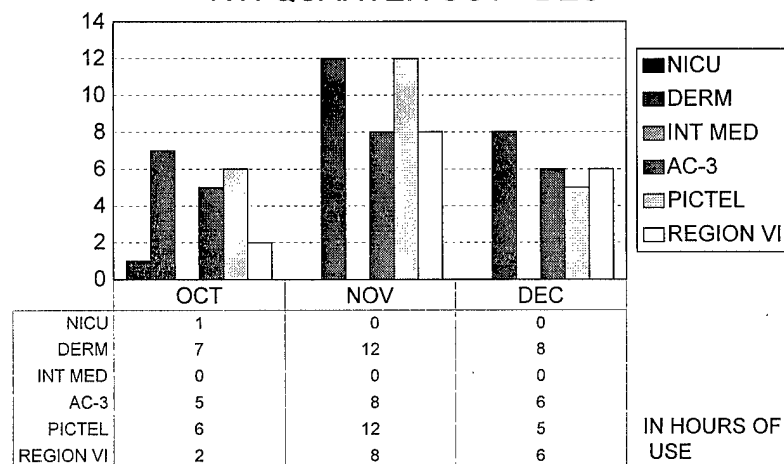
Figure 14 Video Teleconference Usage for 1st Quarter FY 97
(which shows an increased usage in November 97)

TELEMEDICINE
JUL 1 - SEPT 25 1996

	JULY	AUGUST	SEP
NICU	6	4	3
DERM	14	12.5	0
INT MED	0	0	0
AC-3	0	0	0

(IN HOURS OF USE BY MONTH)
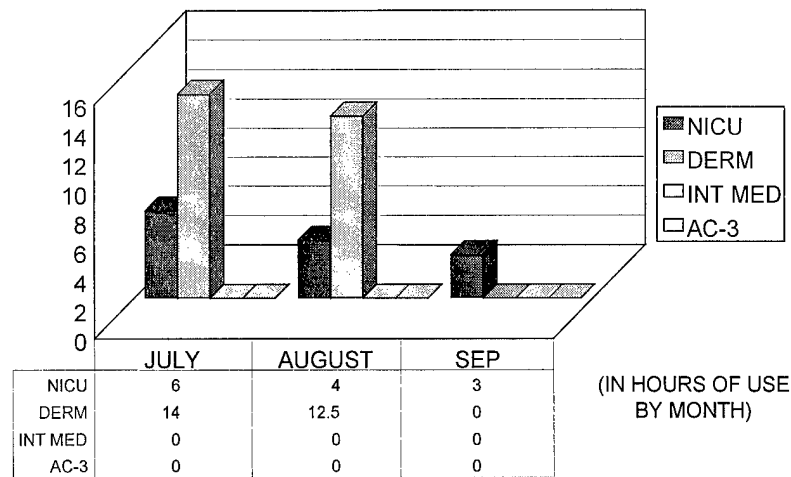
Figure 15 Telemedicine Usage for 4th Quarter FY 96
(which shows a declining usage level especially for September 1996)

CONFIGURATION PRIOR TO MOVE TO NEW HOSPITAL

Prior to BAMC's move to the new hospital, five direct point-to-point T1 lines were shared between any of the 51 designated locations within DACH and BAMC. Two of the lines remained at full T1 rate for the Psychiatry ad Dermatology clinics. The boxes, with the number situated on the right of the service end, indicate the NEC carts and the predominant location for that cart.

(Prior to BAMC move to new hospital)

OB/GYN (3 DROPS)	T1 SPLIT	OB/GYN (4 DROPS) 1403
RADIOLOGY (2 DROPS)		RADIOLOGY (5 DROPS) 1827
NICU (2 DROPS)	T1 SPLIT	NICU (3 DROPS) 2220
SURGERY (2 DROPS)		SURGERY (5 DROPS) 1124
NURSING (3 DROPS)	T1 SPLIT	NURSING (4 DROPS) 1060
HQ SUITE (3 DROPS)		HQ SUITE (4 DROPS)
DERMATOLOGY (4 DROPS)	T1 FULL	DERMATOLOGY (4 DROPS) 1220
PEDIATRICS (2 DROPS)	T1 SPLIT	PEDIATRICS (5 DROPS) 1314
AUDITORIUM (1 DROP)		AUDITORIUM (1 DROP)
OPHTH (3 DROPS)	T1 SPLIT	OPHTH (1 DROP) 2516
INT. MED. (2 DROPS)		INT. MED (6 DROPS) 1246
PSYCH (2 DROPS)	T1 FULL	PSYCH (7 DROPS) 5237
29 DROPS [#] NEC TELEMED CART AND LOCATION	TOTAL	51 DROPS

Figure 16 DACH/OLD BAMC Configuration
(which shows there were 29 drops at Old BAMC and 51 drops at DACH)

The projected configuration after the move to the new BAMC was to extend the TELEOS/IDNX network for total flexibility in the telemedicine/VTC area. The current DACH configuration as of 22 JAN 98 is shown in Figure 17. This configuration depends on a fully operational TELEOS /IDNS network. Unfortunately, due to technical problems, current system is not yet operational. The DACH vision is shown in Figure 18.

In addition, Table 7 shows the location and connectivity of the DACH telemedicine/VTC Equipment at the computer room level.

DACH CONFIGURATION
(JAN 1998)
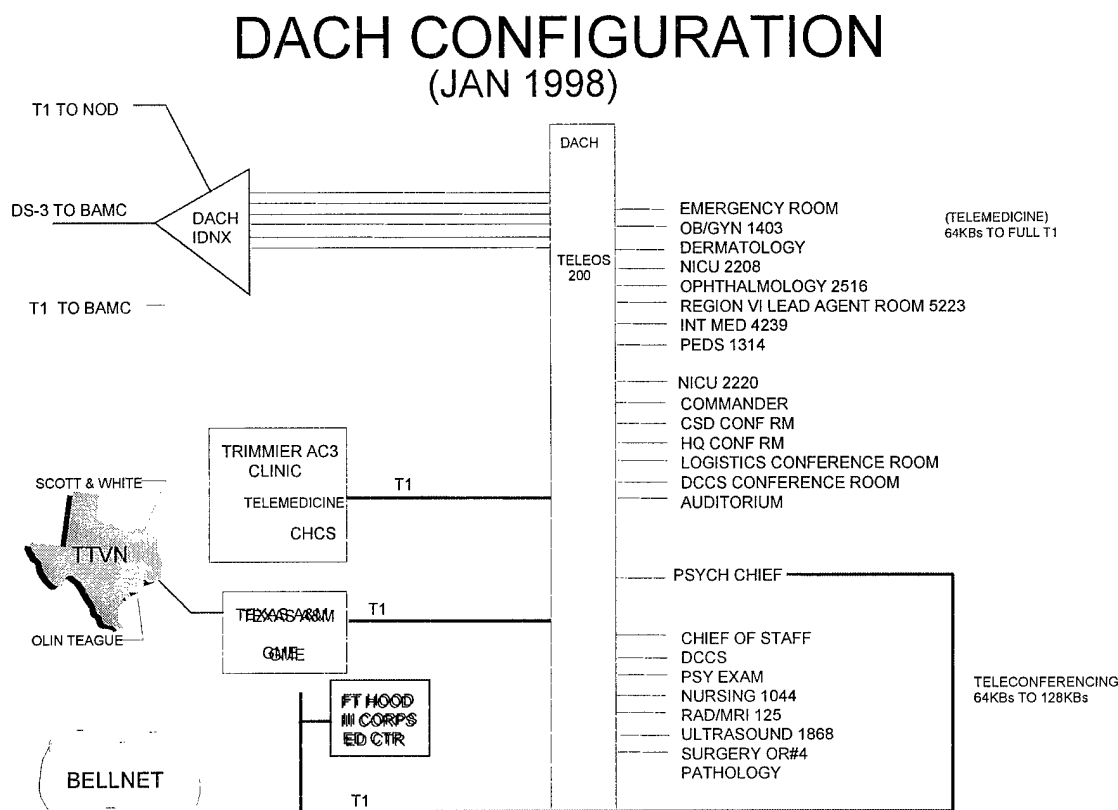
Figure 17 DACH Configuration as of January 1998
(which shows connectivity through the TELEOS)

BAMC - DACH VISION
1998

WILFORD HALL TELEOS

PEDS
NICU

PRI RATE INTERFACE

WHMC IDNX

T1

WILFORD HALL REGION VI LEAD AGENT — REGION VI PICTEL
2 - 56KBs DIAL IN

2 - 56KBs DIAL IN — PICTEL

TTVN

DCTN FTS2000 ACUNET

DS-3

NOD MCU

DS-3

T1

TELEOS NEW BAMC HOSPITAL

SURGERY 255-17
SURGERY 263-11
OB/GYN 167-A
OB/GYN 167-21
DERM 359-6
DERM 358-30
MED 366-8
MED 370-12
OPHTH251-1
OPHTH 255-11
RADS 129-16
RADS 133-7
NESD 333(14-15)
NESD 525-13
CG 529-8
CG 525-1

PRI RATE INTERFACE

DS-3

BAMC IDNX

DS-3

DACH IDNX

PRI RATE INTERFACE

DARNALL TELEOS 200

EMERGENCY ROOM
HQ CONF RM
AUDITORIUM
CSD CONF RM
OB/GYN 1402
RAD MRI 125
ULTRASOUND 1868
SURGERY OR#4
NICU 2220
NICU 2208
OPHTH 2516
DERMATOLOGY 1220
INT MED 1239
PEDS 1314
TELEPATHOLOGY

OLIN TEAGUE

TTVN

TEXAS A&M VTEL GME

T1

SCOTT & WHITE

BELLNET

TRIMMIER T1

FT HOOD ED CTR

COMMANDER
CHIEF OF STAFF
DCCS CHIEF
PSY EXAM 5208
NURSING 1044

BRI 1-16

PSYCH CHIEF
DCCS CONF RM

T1

Figure 18 BAMC/DACH Vision
(which shows connectivity with MEDNET, TTVN and BELNET)

DACH CONFIGURATION
As of 1-22-98

ACTIVATE PRIORITY	ROOM	DEPARTMENT NAME	EQUIP	XCONNECTION ROOM	GROUP	PAIR	COMPUTER RM CABLE	PAIR	TELEOS SLOT	PORT	LINE DRIVER	TYPE	IMUX	NON IMUX	RATE	REMARKS
N/A	0710B	Auditorium B	PicTel		AMO-01	17-20	0710B	17-20	4	1/2	YES	V.35	9-9400	9-9401	T1	
2	2208	NICU	NEC						4	3/4	NO	T-1	9-9402	9-9403		Direct Connection
3	1215	Dermatology	NEC		AMO-13	38-41	1215	38-41	5	1/2	YES	V.35	9-9404	9-9405	Variable	Reserve until Conversion
4	1911	Emergy Room	NEC		AMO-11	13-16	1911	13-16	5	3/4	YES	V.35	9-9406	9-9407	Variable	
5	4239	Internal Medicine	NEC		AMO-13	34-37	4239	34-37	6	1/2	YES	V.35	9-9408	9-9409	Variable	
6	1314	Pediatrics	NEC		AMO-12	51-54	1314	51-54	6	3/4	YES	V.35	9-9410	9-9411	Variable	
7	1403	OB/GYN	NEC	1414	AMO-14	41-44	1403	41-44	7	1/2	YES	V.35	9-9412	9-9413	Variable	
8	2516	Opthalmolology	NEC	2529	AMO-24	40-43	2516	40-43	7	3/4	YES	V.35	9-9414	9-9415	Variable	
9	1034	CMD Conf Rm	NEC	1062	AMO-15	66-69	1034	66-69	9	1/2	YES	V.35	9-9416	9-9417	Variable	
	2415	DCCS Conf Rm	VTEL				2413		9	3/4	YES	V.35	9-9418	9-9419		
1	1060	Commander	NEC	1062	AMO-15	76-79	1060	76-79	10	1/2	YES	V.35	9-9420	9-9421	Variable	
	5223	RGN VI Lead Agent	PicTel	5201	AMO-51	11-14	5239	11-14	10	3/4	YES	V.35	9-9422	9-9423	Variable	
	2821	CSD Conf Rm	VTEL				2821		11	1/2	YES	V.35	9-9424	9-9425	Variable	
	012	Logistics Conf Rm	VTEL		AMO-01	13-19	012	13-19	11	3/4	YES	V.35	9-9426	9-9427	Variable	
	2220	NICU	NEC				220		12	1/2	NO		9-9428	9-9429	Variable	
	AC3	Trimmier Clinic	NEC						12	3/4	YES	V.35	9-9430	9-9431	Variable	
	2425	DCCS		2529	AMO-24	44-47	2425	44-47			YES	V.35				TELEOS not equiped
	1052	Chief of Staff		1062	AMO-15	88-91	1052	88-91			YES	V.35				TELEOS not equiped
	1044	Chief Nurse		1062	AMO-15	84-87	1044	84-87			YES	V.35				TELEOS not equiped
	0710A	Auditorium A	NEC	404	AMO-01	05-08	0710A	05-08			YES	V.35	9-9432	9-9433		TELEOS not equiped
	0125	MRI	NEC	1928	AMO-11	05-08	0125	05-08			YES	V.35	9-9436	9-9437		TELEOS not equiped
	1868	Ultrasound	NEC	1928	AMO-11	09-12	1686	09-12			YES	V.35	9-9436	9-9439		TELEOS not equiped
	1215	Dermatology	NEC	1173	AMO-15	26-29	1220	26-29			YES	V.35				TELEOS not equiped
	2935	OR #4	NEC		AMO-13		2935				NO				T1	Direct Connection
	5208	Psychiatry	NEC	5201	AMO-51	06-09	5208	06-09			YES	V.35				TELEOS not equiped
	702	Pathology	Roche	404	AMO-01	01-04	702	01-04			YES	V.35				TELEOS not equiped

Table 7 DACH Equipment Locations and Connections
(which shows the connectivity at the DACH computer room level)

TELERADIOLOGY

DACH installed a filmless imaging system utilizing the Fugi Image System. This project brought Computed Radiology (CR) units to the 4th ID Bennett Clinic and Monroe TMC. The transmission of images to the MRI section of DCH is via Optical Fiber. The purpose of this system was to eliminate the need for transporting hard copy images from the TMCs to the hospital.
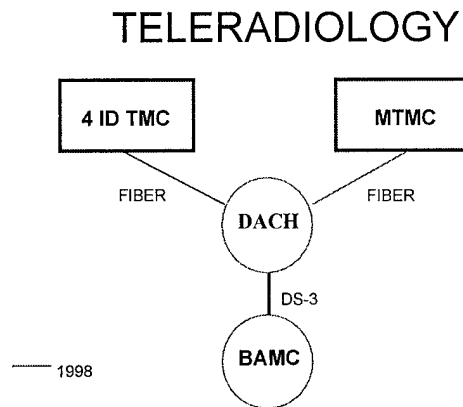
TELERADIOLOGY

Figure 19 DACH Teleradiology Configuration
(which shows DACH connectivity with BAMC, 4th ID MC and Monroe TMC)

TELEPATHOLOGY

The existing system at DACH consisting of sending pathology lab images to the Armed Forces Institute of Pathology over a twin 56Kbs line using a Roshe Imaging System. During the follow-up site visit, a DACH Pathologist demonstrated the ease of use of the system without any assistance from others. It appears that the use of the telepathology technology has been integrated into the regular business practice of the pathology department.
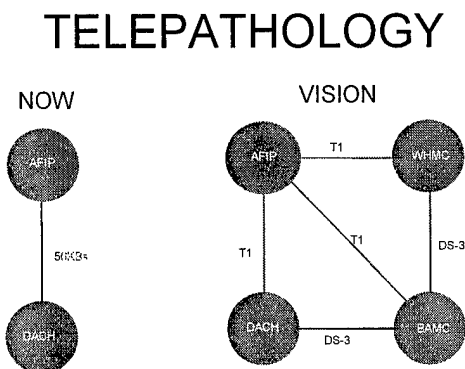
TELEPATHOLOGY

Figure 20 DACH Telepathology Configuration
(which shows DACH connectivity with AFIP now and AFIP/BAMC in the future)

AC-3 CONNECTIVITY

The recently established Adult Chronic Care Clinic (AC3) located in the City of Killeen utilizes T1 data lines between the AC3 and DACH to provide telemedicine capabilities, transmit CHCS data, and utilizes the IFICS system I daily operations.

The configuration today between DACH and AC3 is a combination of leased T1 line and 2 leased 56KBs lines, and a sprint CENTEL telephone system. Figure 21 shows the current and future configuration. The future vision for AC3 is dependent on the TELEOS/IDNS system becoming fully operational.
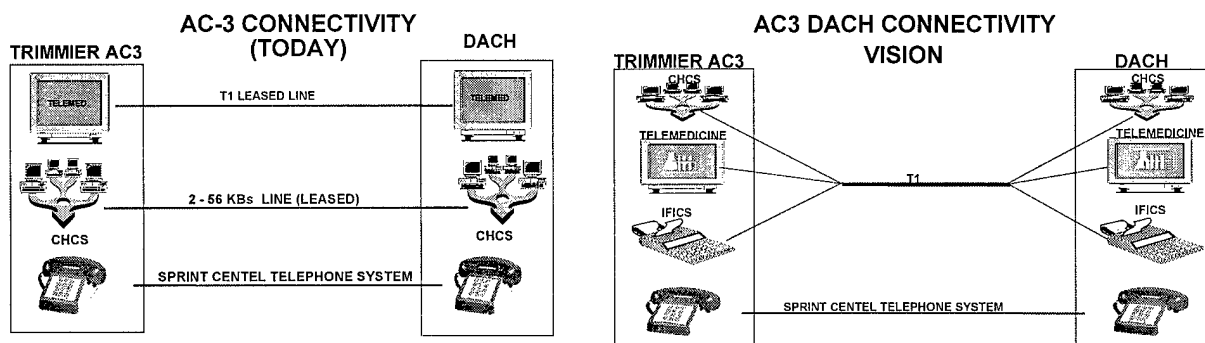
Figure 21 Current and Future AC3 Configuration
(which shows connectivity today and through the TELEOS in the future)

PICTEL VIDEO TELECONFERENCING

Two PicTel VTC system, including a new system installed for use by the Region VI lead agent, is utilized at DACH. Either of the PicTel Systems has the capability to dial-up other PicTel locations or systems that have access to the TTVN. The system utilizes twin 56KBs phone lines for passing data/information. See Figure 22 for the current configuration.

PICTEL VIDEO TELECONFERENCING (NOW)
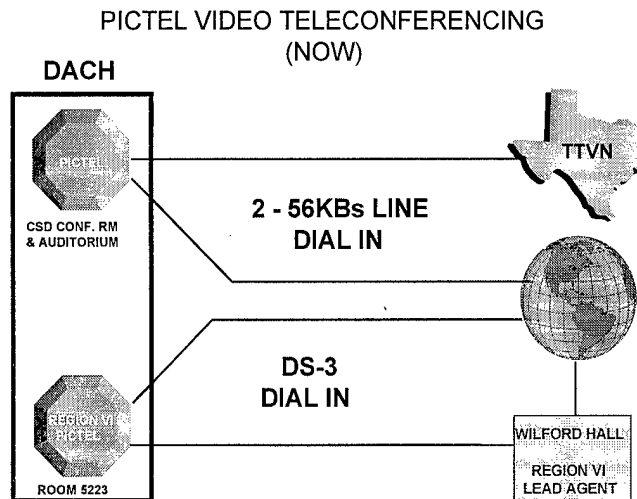
Figure 22 DACH VTC (PicTel) Configuration
(which shows connectivity to TTVN and the Lead Agent)

DACH AWE SUPPORT

DACH provided Level V teleconsultation support for the 97-92 Task Force XXI AWE. The AWE was conducted during 10-30 March, 1997 at Fort Irwin, California in support of the Experimental Force (EXFOR) of the 4th Infantry Division (Mechanized). DACH Emergency Department (ED) provided 24 hour telemedicine consultative support for the exercise. The equipment used at both the National Training Center (NTC) and DACH is shown in Table 8.

NTC EQUIPMENT	DACH EQUIPMENT
- Fairchild Satellite Router	- PictureTel 28 inch monitor/control panel
- CLI Computer Processor	- VCR for recording/ no digitization available
- Satellite Transmitter	- Omnipositional microphone & Camera
- Sony TV with TV Camera	- 56Kbs modem
- Digital Camera	- landlines - DACH 56KBs wiring
- McIntosh Laptop	- VTC Room 1911 - DACH Emergency Dept.
- Adobe Photoshop & Delrina Form Flow	

Table 8 NTC and DACH Configuration for 97-02 Task Force XXI AWE
(which shows a slow but operational system for the AWE)

The patient profile for the NTC included both real-life injuries and play casualties. The real-life injury data is shown in Table 9 below. All 30 real-life injuries were evacuated. The warfighter exercises every other day included 90 to 150 play casualties including trauma, medical, psychiatric, chemical and biological casualties.

TYPE	NO	TYPE	NO
Ortho	10	Derm	1
OB/GYN	5	Opth	1
Psych	3	Neuro	1
IM	2	Dental	1
Pulm	2	Gen Surg	2

Table 9 Real Life Injuries during AWE 97-02
(which shows the actual patient load during the AWE)

LESSONS LEARNED

The major constraints to effective application of telemedicine in service delivery appear to have been due to weather and equipment according to staff. The windstorms during the exercise caused signal fluctuations. The modem speed at 56 KBs was too slow. DACH needed faster lines either via T1 or TELEOS. In addition, there were no digitization capabilities especially for x-ray. The equipment was operational but outdated including the satellite transmitter, the CLI unit, and the modem. The equipment was large and cumbersome. However, the exercise showed that the ED staff two-hour training session prior to deployment improved the experience, the ED was receptive to consults depending on the time of day and the connectivity improved moral of field physicians.

DACH/ TEXAS A&M INITATIVE

The Texas A&M initiative connects DACH to Texas A&M via T1 data lines utilizing a V-TEL video conferencing system. Through this connectivity, DACH was able to conduct video conferencing with a growing number of health and educational facilities supporting the Trans Texas Videoconferencing Network (TTV). The Ft. Hood III Corps Educational Center has utilized a portion of the T1 to Texas A&M to support soldiers assigned to the post participating in educational programs provided by major educational institutions in Texas.

TEXAS A&M CONNECTIVITY
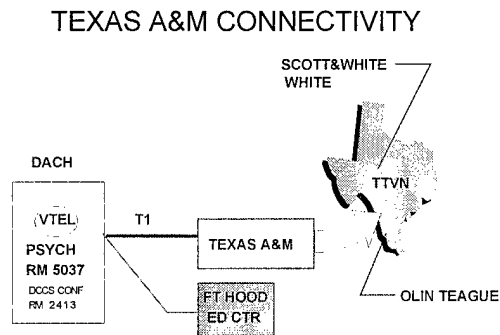
Figure 23 Texas A&M/DACH Configuration
(which shows connectivity with Ft. Hood Education Center to TTVN)

6.5   BAYNE-JONES ARMY COMMUNITY HOSPITAL TELEMEDICINE

The Medical Department Activity at Fort Polk includes Bayne-Jones Community Hospital (BJACH), a Preventive Medicine Service and Department of Psychiatry. BJACH is a 169-bed mid-sized medical facility. The area of responsibility of the Fort Polk MEDDAC includes the entire state of Louisiana[45].

BJACH provides service to approximately 32,000 individuals: 12,000 soldiers, 3,000 retirees, 11,000 family members, and 6,000 others[46]. The 12,000 soldiers include the impact of 60,000 rotational troops per year. Since March 1993, Fort Polk became the official home of the Joint Readiness Training Center (JRTC). The JRTC is the U.S. Army's premier training center for light infantry and special operations units. The clinical staff at BJACH includes 46 military physicians, 28 military and 28 civilian nursing staff, 369 civilians, 35 FTE contractors, 14 Full Time Equivalent (FTE) Red Cross volunteers and 6 deployed active duty military personnel.

Although NEC telemedicine equipment was shipped to BJACH from GPRMC, the REL team was informed that the equipment are still in their shipping crates and have never been in use. However, another department (not IMO) utilized VTC equipment and utilization information has been requested through channels. At the time of this report, no VTC information has been received.

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[45] http://www.polk.amedd.army.mil/about.html
[46] Fox, W., The Joint Commission of the Accreditation of Healthcare Organizations, Oral Presentation, March 1998

At the time of this report, no telemedicine activities were reported at BJACH but there were discussions by the Commander, COL C. William Fox that teleradiology and telepathology services were being considered for future implementation. Therefore, the BJACH Technology Profile (Appendix R) shows a low level of telemedicine activity.

6.6 MEDNET

At the center of the telemedicine network for the Region 6 is a DS3 network called MEDNET. A current map of this network is shown in Appendix S. The hub of this network, the NOD, is located in San Antonio, Texas. The MEDNET began as a small network used to connect the various telemedicine projects grew to over 50 sites by January 1998 and continues to grow in numbers today.

Since recent telemedicine usage data was not available at any of the three sites, the REL team conducted a visit the NOD and was able to obtain some relevant data. The NOD system administrator routinely gathers network information such as network load capacity, and security related information. A billing report for BAMC for February 25, 1998 is shown in Appendix T. Another routine outputs of the monitored activity at NOD was a call duration report which shows the origination and termination of every call from a node (or location), the connection time, and the duration of the call. A sample load report for Node 10 (BAMC) for the period of February 16 to 23, 1998 is shown in Appendix U.

Although the call report does not reveal information concerning the content and the outcome of the telemedicine or VTC usage, it does give a clue into the usage level of various areas/departments that was not available at any of the various sites. With the assistance from NOD Personnel, REL was able to extract some relevant usage level information. For example, BAMC is designated as Node 10 and Wilford Hall Medical Center is designated as Node 100 by the MEDNET NOD. Card 58 (C58) and ports 24 to 46(P24-46) are reserved for MDIS transmissions. Twenty-three consecutive calls with duration about 5 minutes are required for one standard MDIS image. Medical Diagnostic Imaging Systems (MDIS) is a teleradiology system installed at both BAMC and WHMC.

With such information, the attached call duration report may be summarized into the following information concerning telemedicine and VTC usage by BAMC via the MEDNET for the period of February 16 to 23, 1998. A complete summary is also shown in Appendix U.

- Total of 105 calls were initiated for a total of 1,049,112.96 minutes
- Call destinations included: WHMC (N100), Intra BAMC (N10), NOD (N8), DACH (N11), POLK (N12), SILL (N14), MEDCOM (N19), MAMC (N20), BLISS (N51), EAMC (N60), TAMC (N70), CARSON (N80), REILEY (N82), and LEVENWORTH (N83)
- 43 MDIS calls were initiated for a total of 182.99 minutes

6.7   DATA COLLECTION SUMMARY

It is obvious from the information presented in the previous sections 6.2 to 6.6, that more data is necessary to properly evaluate the present AMEDD and AMEDD-led telemedicine initiatives using the health technology assessment tool. Therefore, the following tasks in the Statement of Work cannot be completed without further guidance:

- Analyze current AMEDD and AMEDD-led telemedicine initiatives within the DOD Telemedicine Testbed Database using the telemedicine health technology assessment tool. The assessment tool will incorporate the following criteria into the development methodology:

  - Group similar AMEDD and AMEDD-led telemedicine initiatives based on obvious relationships (Each of the data elements in the health technology assessment tool such as VTC, compatibility, maintenance, efficiency, etc. may serve as the basis to group the data. See Appendix V for one such grouping –VTC, Real-Time, Store-And-Forward applications.)

  - Sequence AMEDD and AMEDD-led telemedicine initiatives by rank order based on value derived by applying the criteria described above (See section 6.8 for assessment tool capability based on simulated data)

  - Analyze initiatives for redundancy and identify superior AMEDD and AMEDD-led telemedicine initiatives based on criteria described above (more data is necessary to properly evaluate for redundancy and identify superior initiatives)

  - Identify existing gaps between current AMEDD and AMEDD-led telemedicine initiatives and recommend new initiatives to accomplish the criteria described above. (More data is necessary to identify gaps between current AMEDD and AMEDD-led telemedicine initiatives and to recommend new initiatives)

- Analyze the merit of each AMEDD and AMEDD-led telemedicine initiatives against the criteria described above. (more data is necessary to analyze the merits of the initiatives)

The summary of required data elements and the results of the data collection in terms of level of completeness is shown in Appendix W. Although the collected data can not be analyzed, the following section, 6.8 presents simulated data in order to validate the health technology assessment tool and its effectiveness in analysis of telemedicine initiatives.

6.8 SAMPLE APPLICATION HEALTH TECHNOLOGY ASSESSMENT TOOL USING SIMULATED DATA

Since the EC models involve the initial allocation of resource, the analysis may include 1) benefits only, 2) cost-benefits, and 3) cost-benefits-risk. All three types of analysis will be addressed in this section of the report. The resulting weights relate to the proportional allocation of resources among the alternatives and do not include the analysis of existing initiatives. However, these weights are critical in determining the weights of the objectives that will be used in the rating model to evaluate the initiatives. In addition, EC Model #3 is explained in detail including all assumptions that were used to synthesize the weights.

#	File Name	5 Objectives	3 Sub(Objective)	Criteria	Alternatives
1	T1A.EC1	All Equal	All Equal	All Equal	All Equal
2	T1B.EC1	Peacetime>all the rest	All Equal	All Equal	All Equal
3	T1D.EC1	Peacetime=all the rest	Care>Tech=Bus	Assumption #1	VTC>Real-time=Store-and-forward

Table 10 EC Model Configurations
(which shows the three simulated evaluation and choice cases and their respective model configurations)

6.8.1 SAMPLE MODEL #1 (EC BENEFIT MODEL)
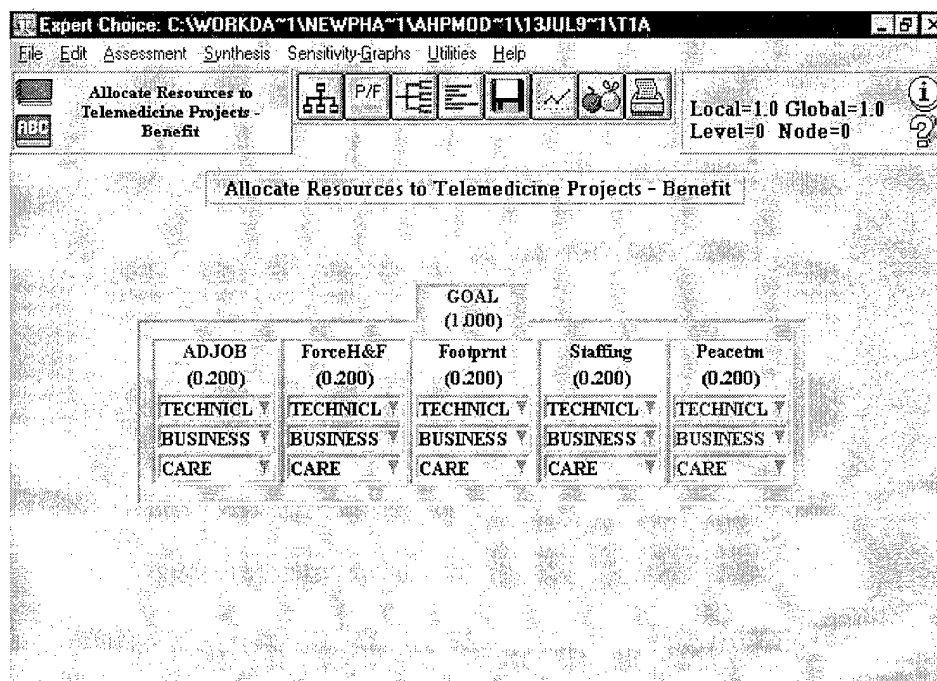
Figure 24 Level I and II of EC Model #1
(which shows EC Model #1 Level I-Goal and II-Objectives)
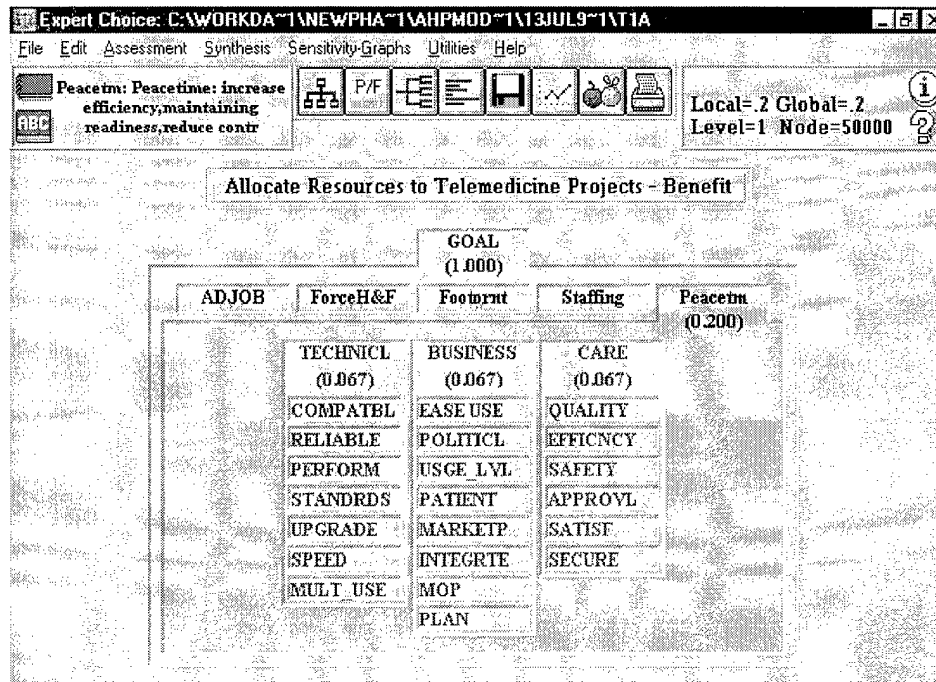
Figure 25 EC Model #1 Level II and III – Peacetime
(which shows EC Model #1 Level II-Objectives and II-(sub) Objectives for peacetime)
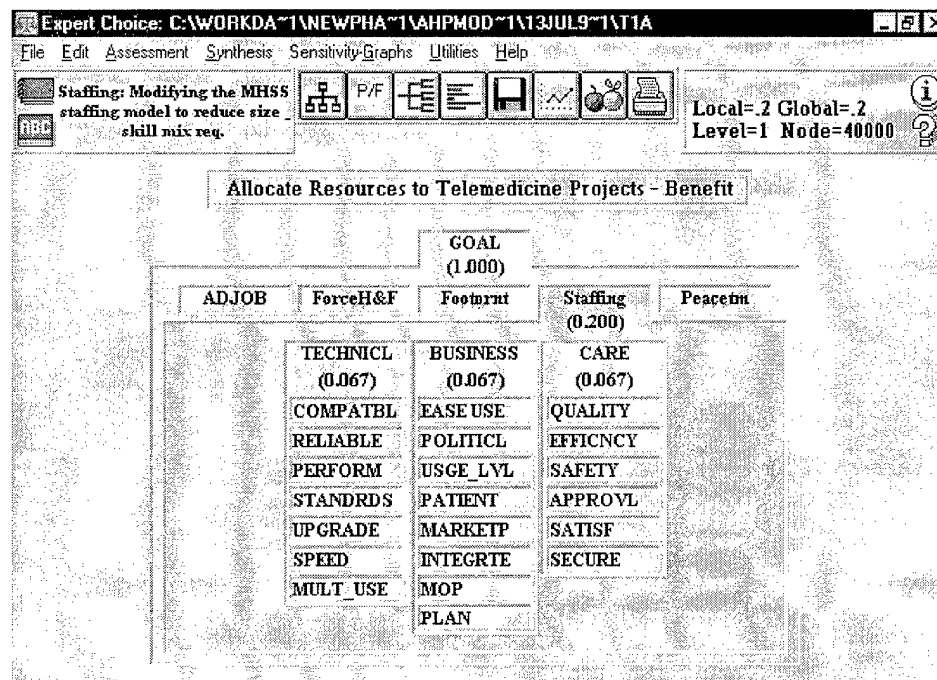
Figure 26 EC Model #1 Level II and III – Staffing
(which shows EC Model #1 Level II-Objectives and III-(sub) Objectives for staffing)
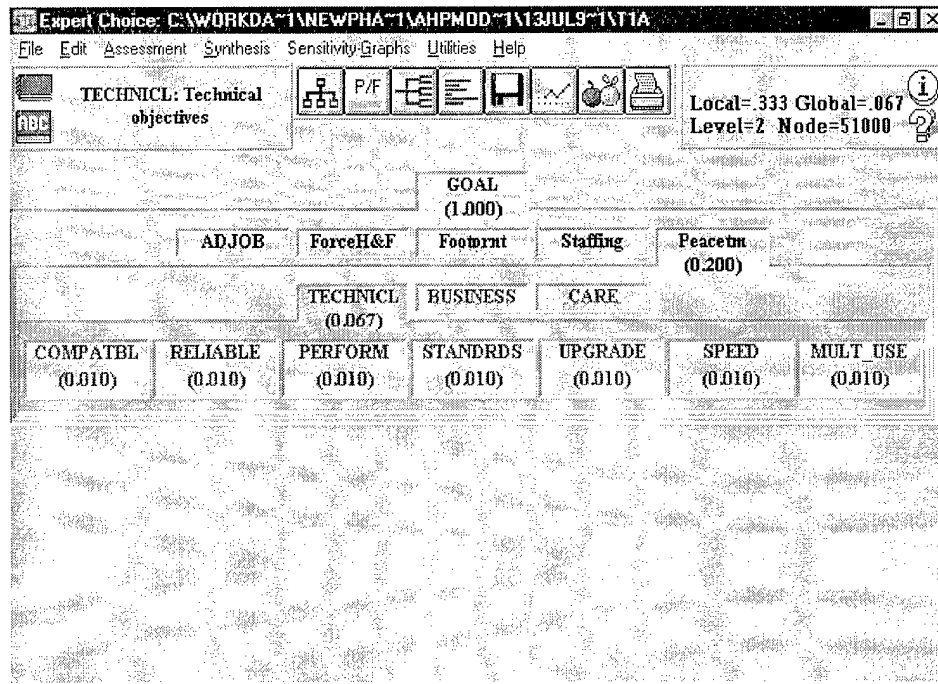
Figure 27 EC MODEL #1 Technical Objective Global Weights (Peacetime)
(which shows EC Model #1 Level IV technical objective global weights for peacetime)
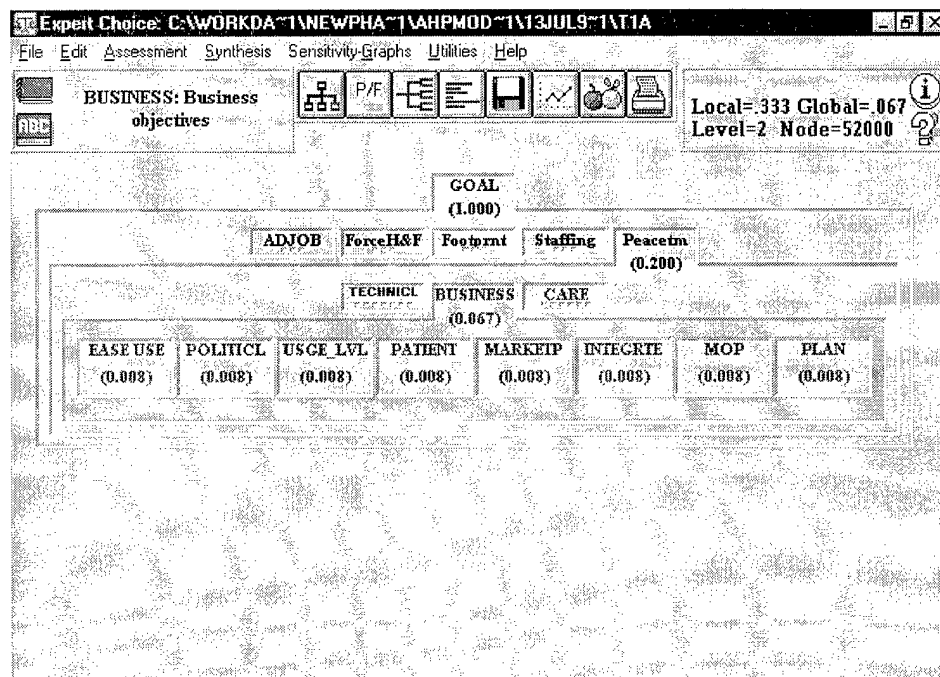
Figure 28 EC Model #1 Business Objective Global Weights (Peacetime)
(which shows EC Model #1 Level IV business objective global weights for peacetime)
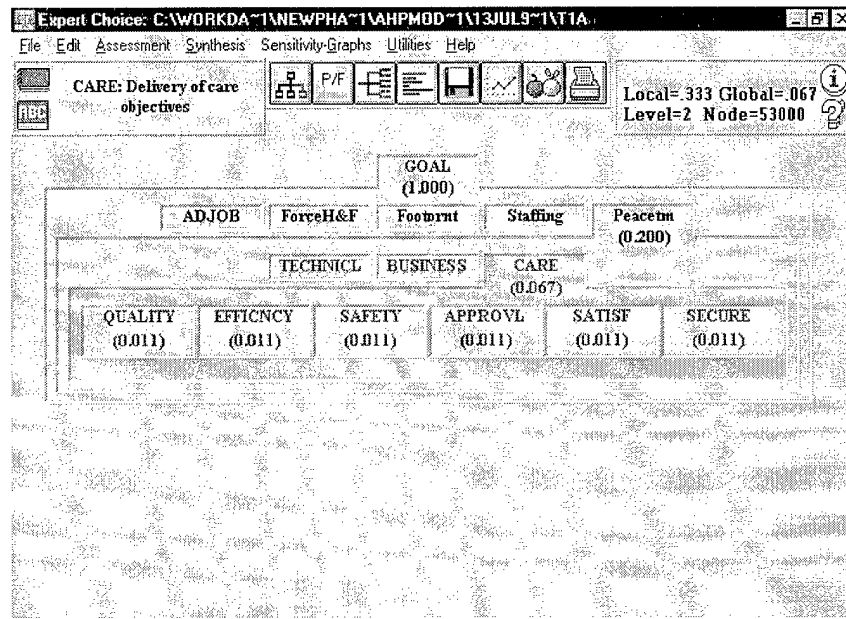
Figure 29 EC Model #1 Delivery of Care Objective Global Weights (Peacetime)
(which shows EC Model #1 Level IV deliver of care objective global weights for peacetime)

MODEL #1 - SUMMARY OF LOCAL AND GLOBAL WEIGHT
(Note: Since the other 4 Level II objectives are the same weight (0.2), their (sub)
Objective weights are the same as the peacetime (sub) Objective weights)

LEVEL II OBJECTIVE	WEIGHTS		LEVEL II OBJECTIVE	WEIGHTS	
	LOCAL	GLOBAL		LOCAL	GLOBAL
AdonJOB	0.200	0.200	MARKETP	0.125	0.008
ForceH&F	0.200	0.200	POLITICAL	0.125	0.008
Footprnt	0.200	0.200	MOP	0.125	0.008
Staffing	0.200	0.200	PLAN	0.125	0.008
Peacetm	0.200	0.200	USAGE_LVL	0.125	0.008
LEVEL III - TECHNICAL	0.333	0.067	PATIENT	0.125	0.008
COMPATBL	0.143	0.010	LEVEL III - CARE	0.333	0.067
RELIABLE	0.143	0.010	QUALITY	0.167	0.011
PERFORM	0.143	0.010	EFFICNCY	0.167	0.011
STANDRDS	0.143	0.010	SAFETY	0.167	0.011
UPGRADE	0.143	0.010	APPROVL	0.167	0.011
SPEED	0.143	0.010	SATISF	0.167	0.011
MULT_USE	0.143	0.010	SECURE	0.167	0.011
LEVEL III - BUSINESS	0.333	0.067			
EASE USE	0.125	0.008			
INTEGRTE	0.125	0.008			

Table 11 Summary of EC Model #1 Local and Global Weights (Peacetime)
(which shows the derived local and global weights for Model #1)

6.8.2 SAMPLE MODEL #2 (EC BENEFIT MODEL)
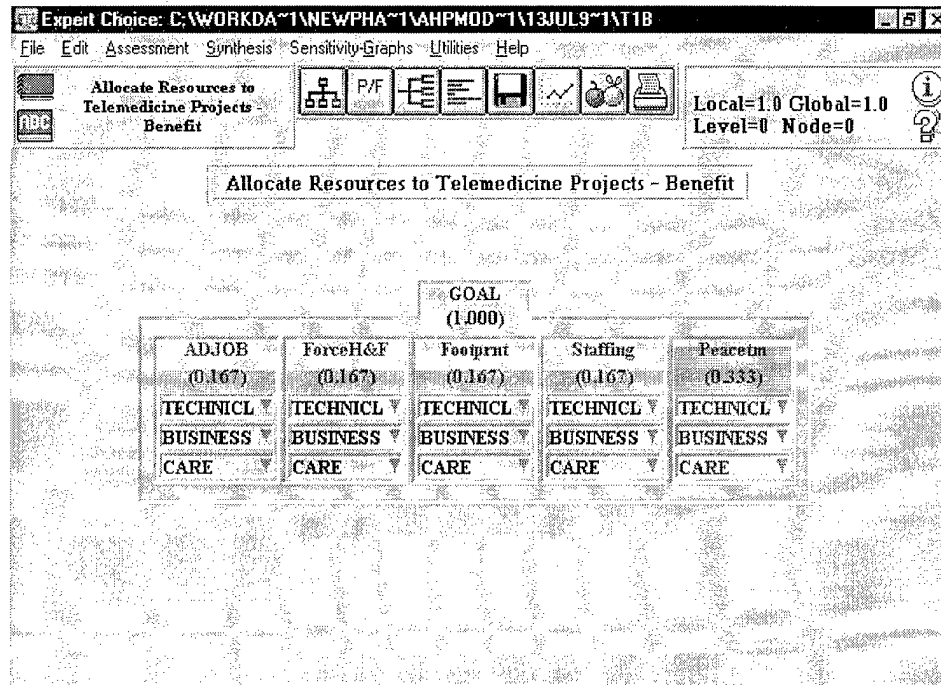
Figure 30 EC Model #2 Level I and II
(which shows EC Model #2 Level I-Goal and Level II-Objectives)

Figure 31 EC Model #2 Levels II and III (Peacetime)
(which shows EC Model #2Level II-objectives and III-(sub) objectives for peacetime)

File Edit Assessment Synthesis Sensitivity-Graphs Utilities Help

Staffing: Modifying the MHSS
staffing model to reduce size
skill mix req.

Local=.167 Global=.167
Level=1 Node=40000

Allocate Resources to Telemedicine Projects – Benefit

		GOAL (1.000)		
ADJOB	ForceH&F	Footprnt	Staffing (0.167)	Peacetm

TECHNICL (0.056)	BUSINESS (0.056)	CARE (0.056)
COMPATBL	EASE USE	QUALITY
RELIABLE	POLITICL	EFFICNCY
PERFORM	USGE LVL	SAFETY
STANDRDS	PATIENT	APPROVL
UPGRADE	MARKETP	SATISF
SPEED	INTEGRTE	SECURE
MULT_USE	MOP	
	PLAN	

Figure 32 EC Model #2 Level II and III (Reduce Staffing)
(which shows EC Model #2 Level II-objective and III-(sub) objective for staffing)

File Edit Assessment Synthesis Sensitivity-Graphs Utilities Help

TECHNICL: Technical
objectives

Local=.333 Global=.111
Level=2 Node=51000

			GOAL (1.000)			
	ADJOB	ForceH&F	Footprnt	Staffing	Peacetm (0.333)	

	TECHNICL (0.111)	BUSINESS	CARE		

COMPATBL (0.016)	RELIABLE (0.016)	PERFORM (0.016)	STANDRDS (0.016)	UPGRADE (0.016)	SPEED (0.016)	MULT USE (0.016)

Figure 33 EC Model #2 Technical Objective Global Weights (Peacetime)
(which shows EC Model #2 Level IV Technical objective global
weights for peacetime)

Figure 34 EC Model #2 Business Objective Global Weights (Peacetime)
(which shows EC Model #2 Level IV Business Objective Global
weights for peacetime)
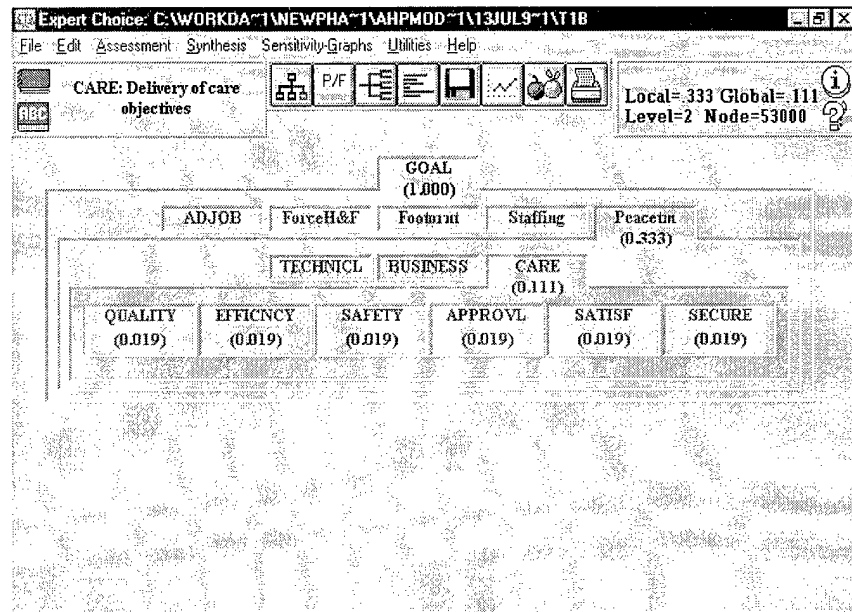
Figure 35 EC Model #2 Delivery of Care Objective Global Weights (Peacetime)
(which shows Model #2 Level IV Delivery of care objective global
weights for peacetime)

MODEL #2 SUMMARY OF WEIGHTS

MODEL #2	WEIGHTS		MODEL #2	WEIGHTS	
LEVEL II OBJECTIVE	**LOCAL**	**GLOBAL**	**LEVEL II OBJECTIVE**	**LOCAL**	**GLOBAL**
AdonJOB	0.167	0.167	MARKETP	0.125	0.014
ForceH&F	0.167	0.167	POLITICAL	0.125	0.014
Footprnt	0.167	0.167	MOP	0.125	0.014
Staffing	0.167	0.167	PLAN	0.125	0.014
Peacetm	0.333	0.333	USAGE_LVL	0.125	0.014
LEVEL III - TECHNICAL	0.333	0.111	PATIENT	0.125	0.014
COMPATBL	0.143	**0.016**	**LEVEL III - CARE**	0.333	0.111
RELIABLE	0.143	0.016	QUALITY	0.167	0.019
PERFORM	0.143	0.016	EFFICNCY	0.167	0.019
STANDRDS	0.143	0.016	SAFETY	0.167	0.019
UPGRADE	0.143	0.016	APPROVL	0.167	0.019
SPEED	0.143	0.016	SATISF	0.167	0.019
MULT_USE	0.143	0.016	SECURE	0.167	0.019
LEVEL III - BUSINESS	0.333	0.111			
EASE USE	0.125	0.014			
INTEGRTE	0.125	0.014			

Table 12 Summary of EC Model #2 Local and Global Weights (Peacetime)
(which shows the derived local and global weights for Model #2)

6.8.3 SAMPLE MODEL #3 (EC BENEFIT MODEL-Peacetime)

6.8.3.1 Assumptions

LEVEL II OBJECTIVES

- All objectives are weighted equally i.e. keeping active duty forces on the job is equally important than peacetime objectives

LEVEL III OBJECTIVES

- Delivery of care objectives are slightly more important than technical objectives or business objectives.

- Business and technical objectives are of equal importance.

LEVEL IV BENEFIT OBJECTIVES

TECHNICAL (BENEFIT)

Group #1 – Reliability
Group #2 – Speed and Performance
Group #3 – Compatibility, Multiple uses, Standards, and Upgrade

Group #1 is equally to moderately more preferable to Group #2.
Group #2 is equally to moderately more preferable to Group #3.
Group #1 is moderately more preferable to Group #3.

BUSINESS (BENEFIT)

Group #1 – Ease of Use, Measures of performance, Management
       or Project Plan
Group #2 – Usage level, Market place, Integrate
Group #3 – Patient population, political

Group #1 is equally to moderately more preferable to Group #2.
Group #2 is equally to moderately more preferable to Group #3.
Group #1 is moderately more preferable to Group #3.

DELIVERY OF CARE (BENEFIT)

Group #1 – Quality of care, Safety
Group #2 – Efficiency, Approval
Group #3 – Satisfaction, security

Group #1 is equally to moderately more preferable to Group #2.
Group #2 is equally to moderately more preferable to Group #3.
Group #1 is moderately more preferable to Group #3.

ALTERNATIVES (BENEFIT)

- Store-and-forward applications are slightly more preferable to
  Real-time applications

- Real-time applications are slightly more preferable to VTC
  applications

6.8.3.2 EC Model #3 (Benefit)

A benefit model can be constructed using the pair-wise comparison to generate relative weights and finally global weights for the three alternatives (VTC, Real-Time, and Store-and-Forward applications). The EC model is shown below.
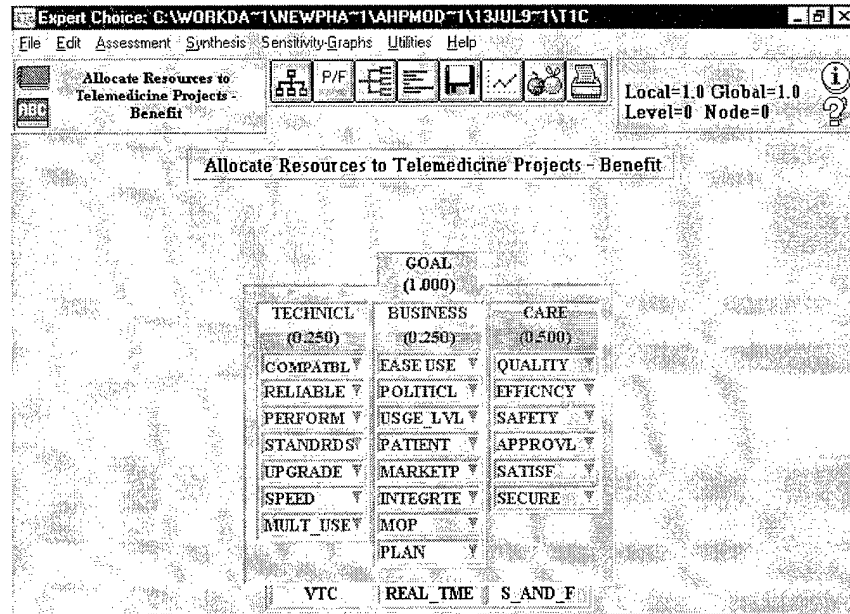
Figure 36 EC Model #3 Level I and II
(which shows EC Model #3 Level II-Objective and III-(sub) Objectives for peacetime)
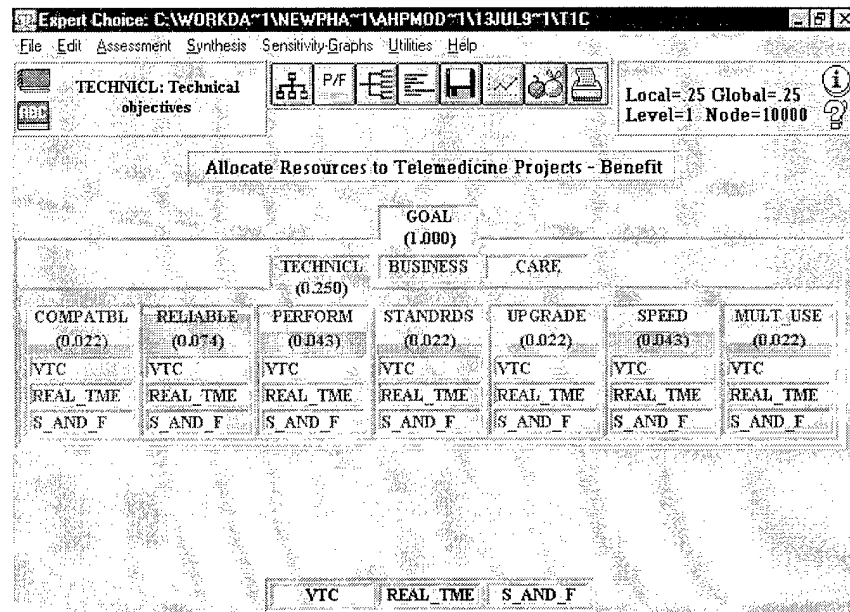
Figure 37 EC Model #3 of Technical Objective Global Weights (Peacetime)
(which shows EC Model #3 Level IV Technical objective global weights for peacetime)
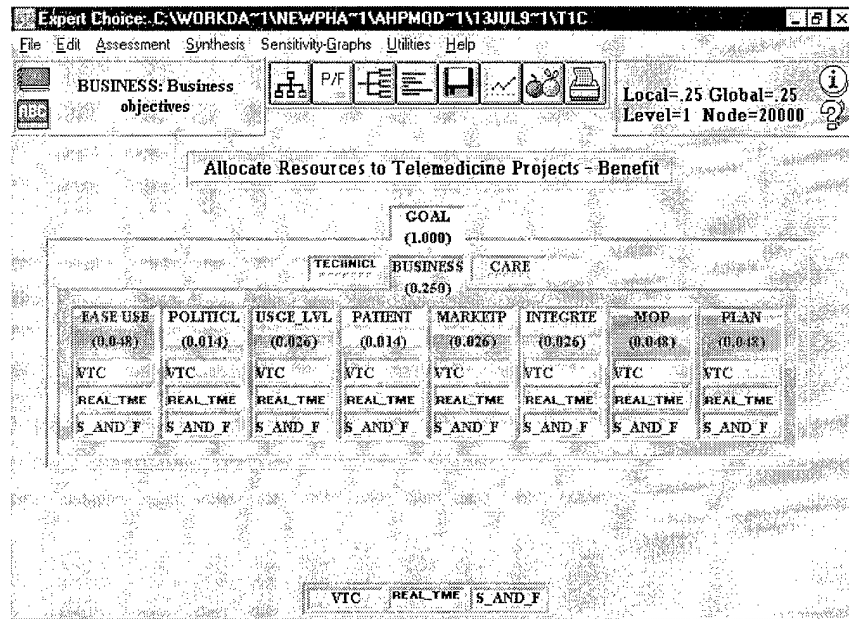
Figure 38 EC Model #3 Business Objective Global Weights (Peacetime)
(which shows EC Model #3 Level IV Business objective global weights for peacetime)
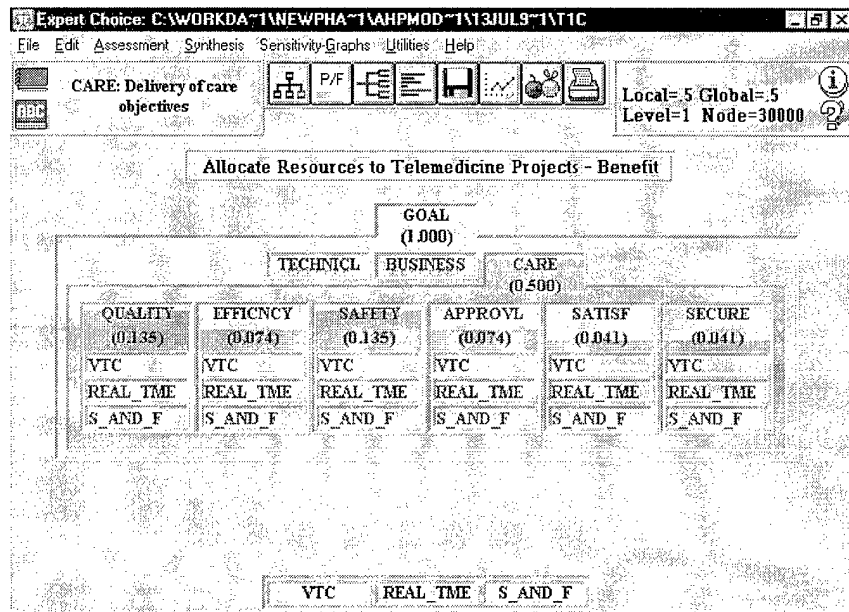
Figure 39 EC Model #3 Delivery of Care Objective Global Weights (Peacetime)
(which shows EC Model #3 Delivery of care objective global weights for peacetime)

MODEL #3 SUMMARY OF WEIGHTS

MODEL #3	WEIGHTS			WEIGHTS	
LEVEL II OBJECTIVE	**LOCAL**	**GLOBAL**	**LEVEL II OBJECTIVE**	**LOCAL**	**GLOBAL**
AdonJOB	0.200	0.200	MARKETP	0.103	0.026
ForceH&F	0.200	0.200	POLITICAL	0.058	0.014
Footprnt	0.200	0.200	MOP	0.192	0.048
Staffing	0.200	0.200	PLAN	0.192	0.048
Peacetm	0.200	0.200	USAGE_LVL	0.103	0.026
LEVEL III - TECHNICAL	0.250	0.250	PATIENT	0.103	0.026
COMPATBL	0.090	**0.022**	**LEVEL III - CARE**	0.500	0.500
RELIABLE	0.294	0.074	QUALITY	0.270	0.135
PERFORM	0.173	0.043	EFFICNCY	0.148	0.074
STANDRDS	0.090	0.022	SAFETY	0.270	0.135
UPGRADE	0.090	0.022	APPROVL	0.148	0.074
SPEED	0.173	0.043	SATISF	0.082	0.041
MULT_USE	0.090	0.022	SECURE	0.082	0.041
LEVEL III - BUSINESS	0.250	0.250			
EASE USE	0.192	0.048			
INTEGRTE	0.058	0.014			

Table 13 Summary of EC Model #2 Local and Global Weights (Peacetime)
(which shows the derived local and global weights for Model #3)

6.8.3.3 Sensitivity Analysis (Benefit Model)

Sensitivity analysis is used to investigate the sensitivity of the alternatives to changes in the priorities of the criteria. Sensitivity analyses are started from the Sensitivity-Graphs command on the main menu of Evaluation and Choice. Sensitivity and Sensitivity-Graphs both refer to the same sensitivity analysis features of Evaluation and Choice.

Sensitivity analysis from the GOAL node will show the sensitivity of alternatives with respect to the criteria immediately below the goal. Sensitivity analysis can also be invoked from nodes farther down in the tree if the model has more than three levels. When the sensitivity analysis is performed from, for example, a criterion node immediately below the goal, the sensitivity is with respect to the (sub) criteria below the criterion node. There are five graphical sensitivity analysis modes:

- Performance
- Dynamic
- Gradient
- 2D Plot (Two-Dimensional)
- Differences

All five graphical sensitivity modes provide views of priorities and alternatives in the model and how they are related. The views available in the different modes provide emphasize on different aspects of the model's priorities. Though all views of the model's include criteria and alternatives, what is emphasized in the graphical visualization for the sensitivity modes varies. For example, "Differences" emphasizes the differences between the alternatives given the criteria while the "2-D Plot" emphasize the relationships between criteria as they apply to the alternatives in the model. The sensitivity analysis modes are not designed to provide different substantive alternatives for altering the model -- the structure of the model itself is a model building issue. Additionally, priority adjustments made for sensitivity analysis in one open mode are reflected in all the currently open sensitivity modes for the model. Each mode has a status bar at the bottom of the screen that tells the type of sensitivity being viewed, whether the synthesis was performed in Distributive or Ideal mode, as well as the date and time.

An example of performance sensitivity analysis is shown with the technical (sub) objective with respect to the goal. Figure 40 shows all five sensitivity analysis for EC Model #3 for the technical criteria with respect to the goal. The following example shows how sensitivity analysis may be performed.
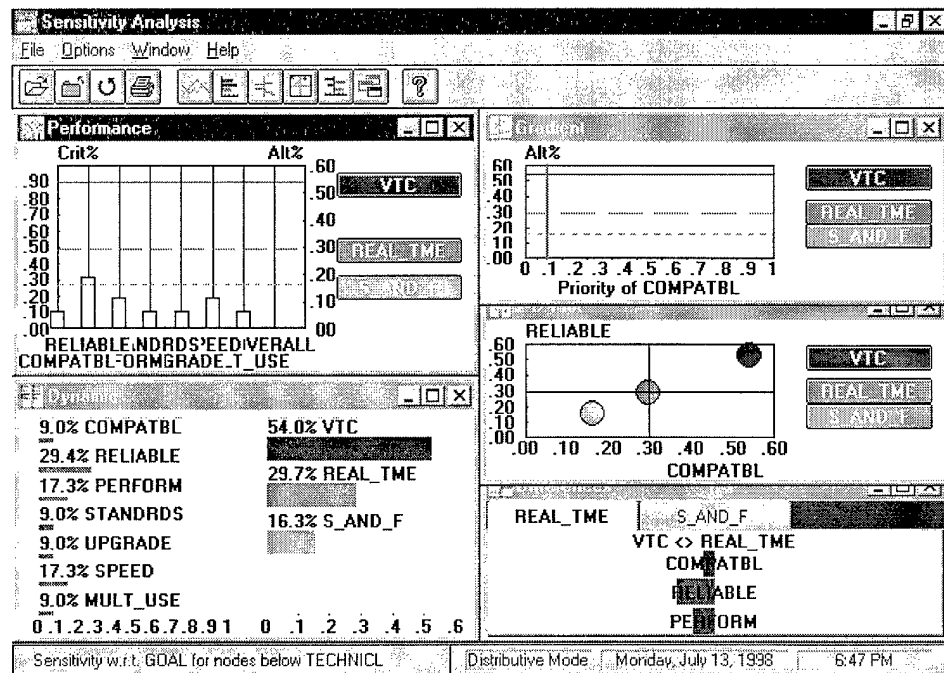
Figure 40 Original EC Model # 3 Sensitivity Analysis
(which shows the original technical and performance objective weights
with respect to the goal)

PERFORMANCE GRAPH
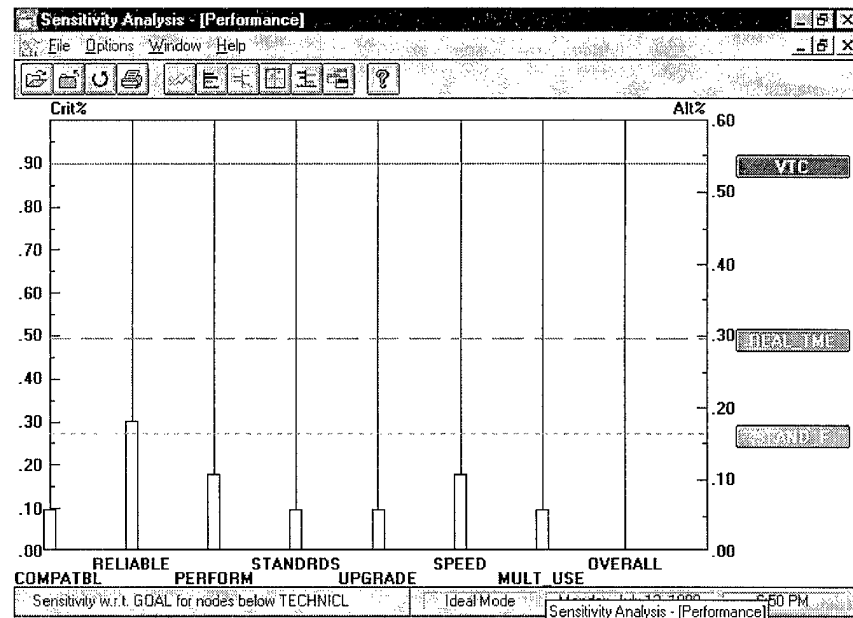
Figure 41 New Model #3 Performance Graph
(which shows the relative weights of the new technical and performance objective)

The performance graph displays all the information about how alternatives behave vis-à-vis each criterion on a single screen. This is the most compact presentation of the information about the priorities. Figure 40 shows the original weights of the technical objectives and Figure 41 shows the new relative weights by moving the desired vertical bar. In this case, the "RELIABLE" bar was increased from 29.4% to 31.8% and the "PERFORMANCE" bar was increased from 17.3% to 34.1%.

The performance graph provides a composite sensitivity presentation showing how well each alternative performs on each criterion and overall, when all the criteria are taken into account. Each criterion (in this case, technical, business, and care objective) is shown by a vertical line. The point where an alternative line intersects such a vertical line, as read from the axis on the *right* (labeled "Alt%"), indicates the priority the alternative received on that criterion. In this case, the Store-and-Forward green line intersects the right axis at the 29.1%. The overall priority of each alternative is where it intersects the rightmost axis.

The priority of each criterion is shown by the small blue rectangular box on that criterion's vertical line, as read from the axis at the left (labeled Crit%). What-If analysis is done by dragging the box up and down the vertical line to change the priority of the criterion. As the priority changes, the overall priorities of the alternatives on the axis at the right change and the other priorities are readjusted to accommodate the

changes. In this case, changing the criteria level will not affect the weighting of the alternatives but the weighting of the criteria that will be used in the Ratings Model. The next point may seem obvious but it is important to distinguish which pair-wise comparison changes which local/global weights. The weighting of the alternatives are changed not through the pair-wise comparison of the criteria (reliability, performance, etc.) but through the changing the pair-wise comparison of the alternatives (VTC, Real-Time, Store-and-Forward). Therefore, Figure 42 shows the result of increasing the reliability and performance criteria. All the other criteria weights have decreased in response to this What-If scenario.
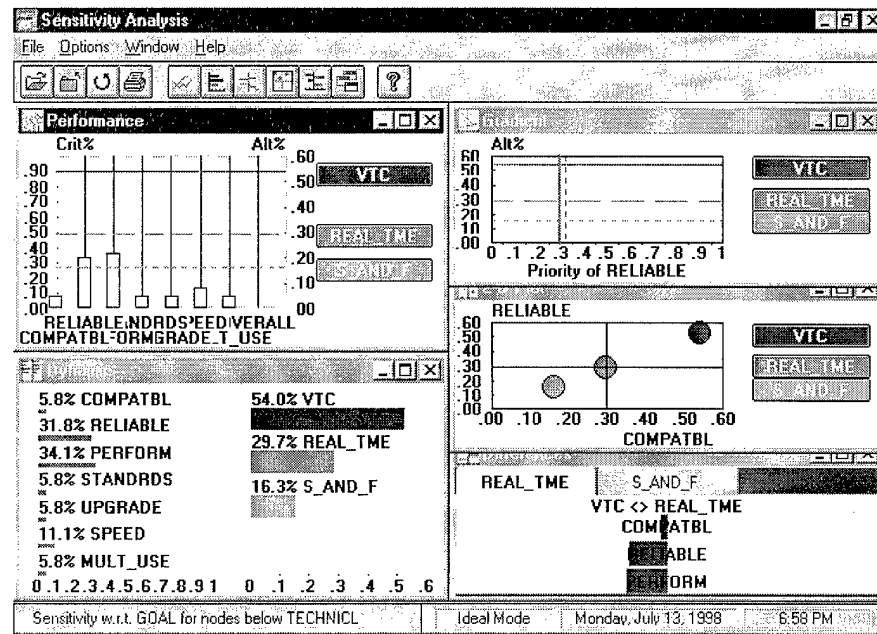
Figure 42 New EC Model #3 Sensitivity Analysis
(Which shows the resulting weights of increasing the reliability and performance criteria)

Now back to the original Model #3 configuration and assumptions. In summary, the sample EC model shows that the following proportion of resources should be allocated to VTC, Real-Time, and Store-and-Forward telemedicine applications.

Assumption – Initial allocation $50M

OBJECTIVES	Global Weights	Funding Amount
- Active Duty Forces on the Job	0.2	$10M
- Force Health and Fitness	0.2	$10M
- Reduce Footprint	0.2	$10M
- Reduce Staffing	0.2	$10M
- Peacetime	0.2	$10M
TOTAL	1.0	$50M

| | Global Weights with respect to | | |
ALTERNATIVES	Peacetime	Goal	Funding Amount
- VTC Applications	0.540	0.1080	$5.40M
- Real-Time Applications	0.297	0.0594	$2.97M
- Store-and-Forward Appl.	0.163	0.0326	$1.63M
TOTAL	1.000	0.2000	$10.0M

6.8.4 SAMPLE MODEL #4 (EC COST MODEL – PEACETIME)

6.8.4.1 Assumptions

LEVEL II OBJECTIVES

- All objectives are weighted equally i.e. keeping active duty forces on the job is equally important than peacetime objectives

LEVEL III OBJECTIVES

- Delivery of care objectives are slightly more important than technical objectives or business objectives.

- Business and technical objectives are of equal importance.

LEVEL IV COST OBJECTIVES

TECHNICAL (COST)

Group #1 – Size, Weight
Group #2 – Maintenance (Maintain), Custom
Group #3 – Assembly

Group #1 is equally to moderately more preferable to Group #2.
Group #2 is equally to moderately more preferable to Group #3.
Group #1 is moderately more preferable to Group #3.

BUSINESS (COST)

Group #1 – On-going Capital, Schedule, Transmission $
Group #2 – Initial capital, Training
Group #3 – Facility

Group #1 is equally to moderately more preferable to Group #2.
Group #2 is equally to moderately more preferable to Group #3.
Group #1 is moderately more preferable to Group #3.

DELIVERY OF CARE (COST)

Group #1 – Clinician Inconvenience, Patient Discomfort, Patient
            Movement
Group #2 – Patient Inconvenience, Patient Confinement
Group #3 – Patient Delays

Group #1 is equally to moderately more preferable to Group #2.
Group #2 is equally to moderately more preferable to Group #3.
Group #1 is moderately more preferable to Group #3.

6.8.4.2 EC MODEL #4 (COST MODEL)

A benefit model can be constructed using the pair-wise comparison to generate relative weights and finally global weights. A sample EC cost model is shown in Figure 43 below.
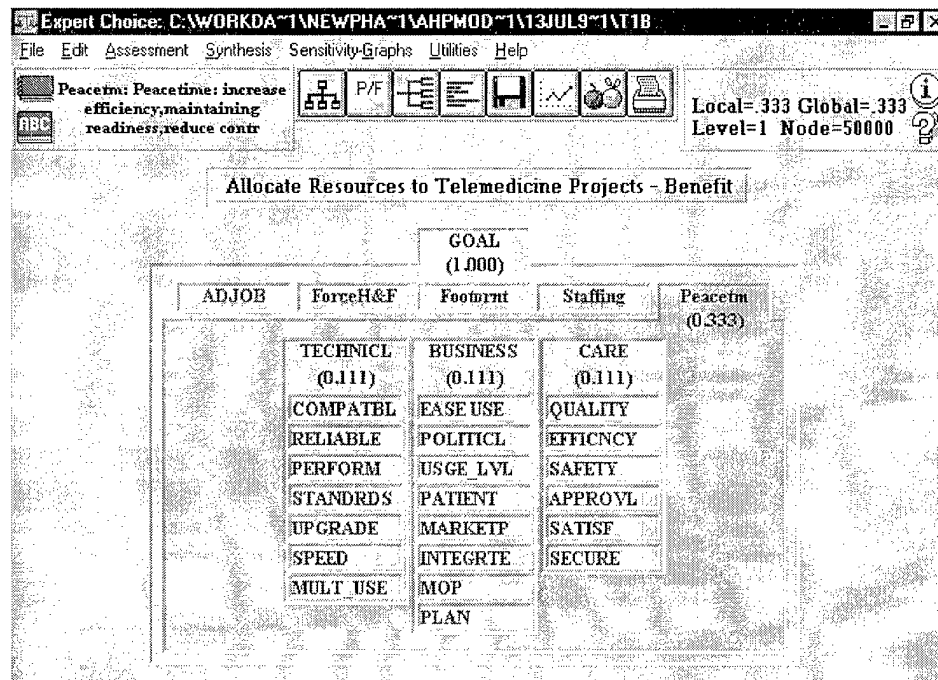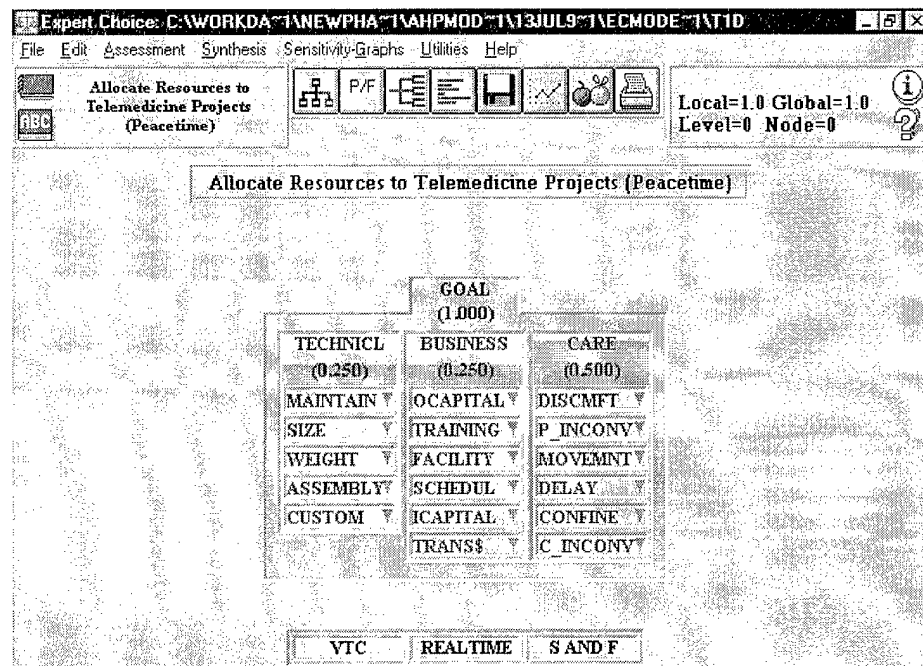

Figure 43 EC MODEL #4 Level I and II (Peacetime)
(which shows EC Model #4 Level I-Goal and II-Sub(objectives) for peacetime)
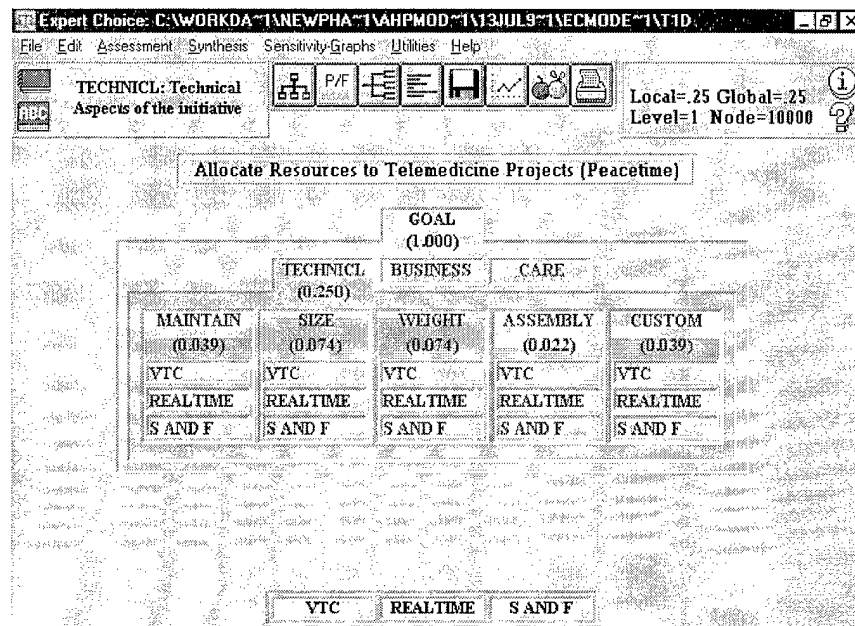
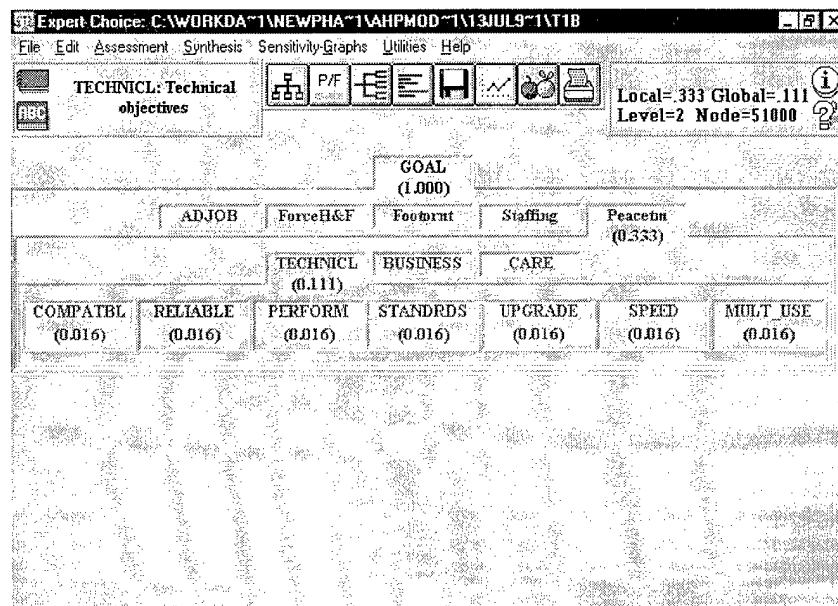Figure 44 EC Model #4 of Technical Objective Global Weights (Peacetime)
(which shows EC Model #4 Level IV Technical Objective global weights for peacetime)
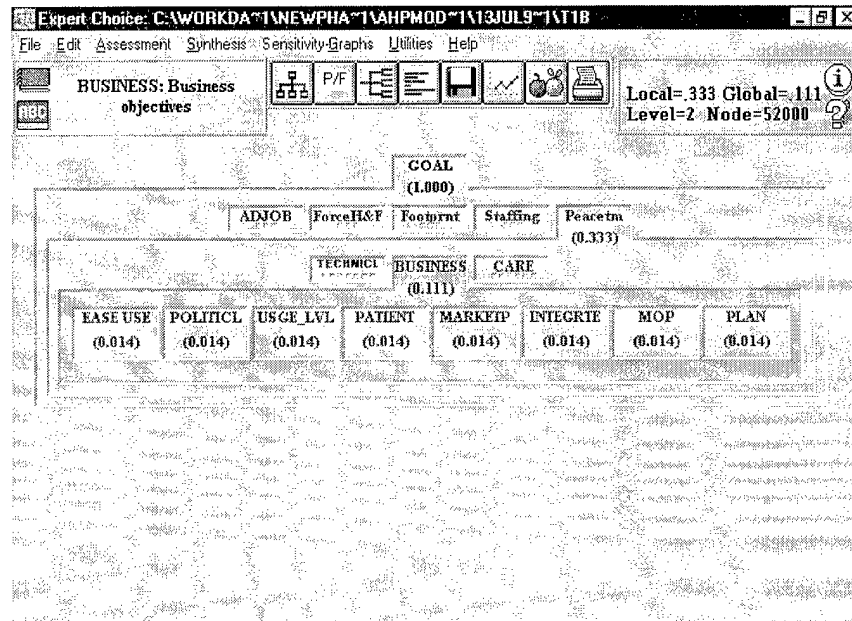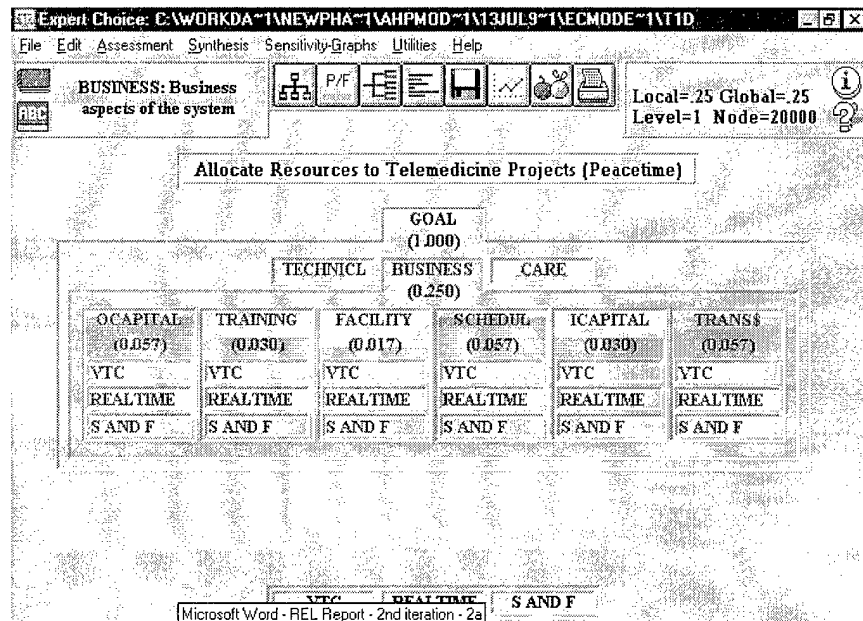

Figure 45 EC Model #4 of Business Objective Global Weights (Peacetime)
(which shows EC Model #4 Level IV Business objective global weights for peacetime)
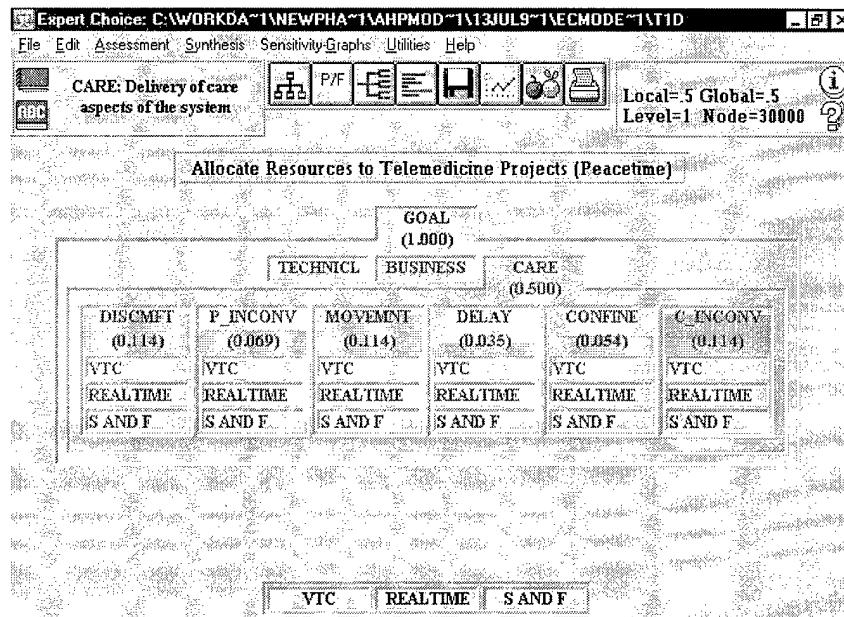
Figure 46 EC Model #4 (Cost) of Business Objective Global Weights (Peacetime) (which shows EC Model #4 Level I business objective global weights for peacetime)

6.8.5 EC MODEL #5 (RISK MODEL)

<u>LEVEL II OBJECTIVES</u>

- All objectives are weighted equally i.e. keeping active duty forces on the job is equally important than peacetime objectives

<u>LEVEL III OBJECTIVES</u>

- Delivery of care objectives are slightly more important than technical objectives or business objectives.

- Business and technical objectives are of equal importance.

<u>LEVEL IV RISK OBJECTIVES</u>

- Technical risk is slightly more likely than Cost risk

- Cost risk is slightly more likely than Schedule risk

- Technical risk is moderately more likely than Schedule risk
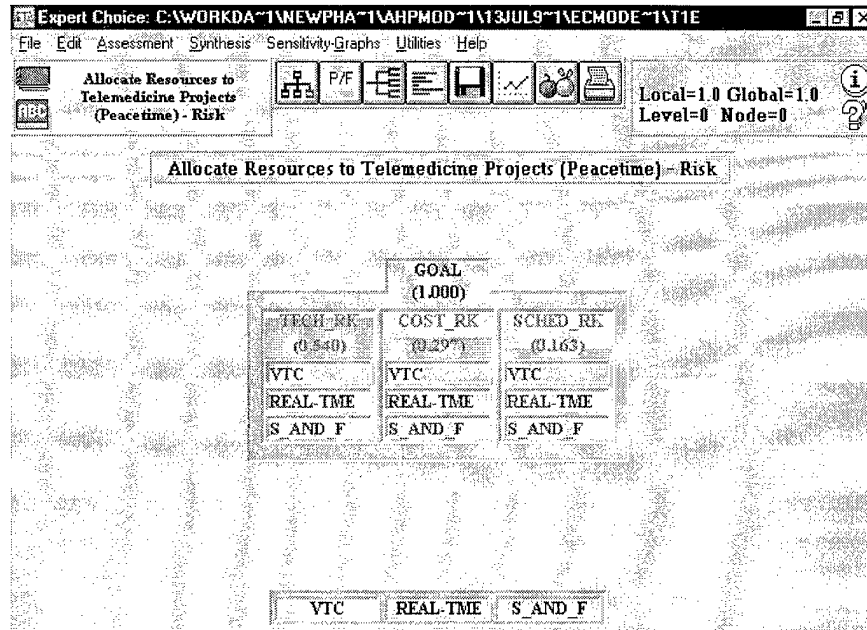
Figure 47 EC Model #5 Level I and II
(which shows EC Model #5 Level I-Goal and II-Objectives)
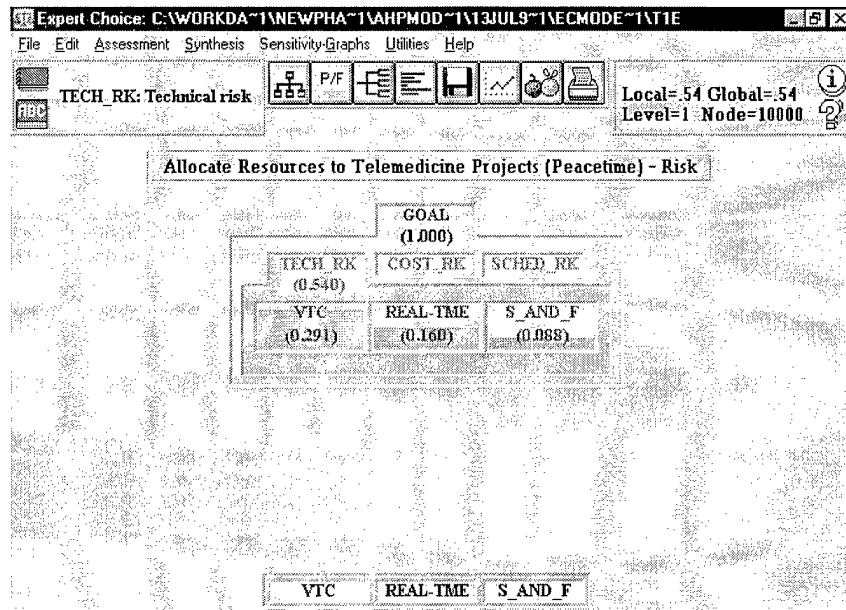
Figure 48 EC Model #5 Technical Risk Objective Global Weights (Peacetime)
(which shows EC Model #5 Technical risk objective global weights for peacetime)
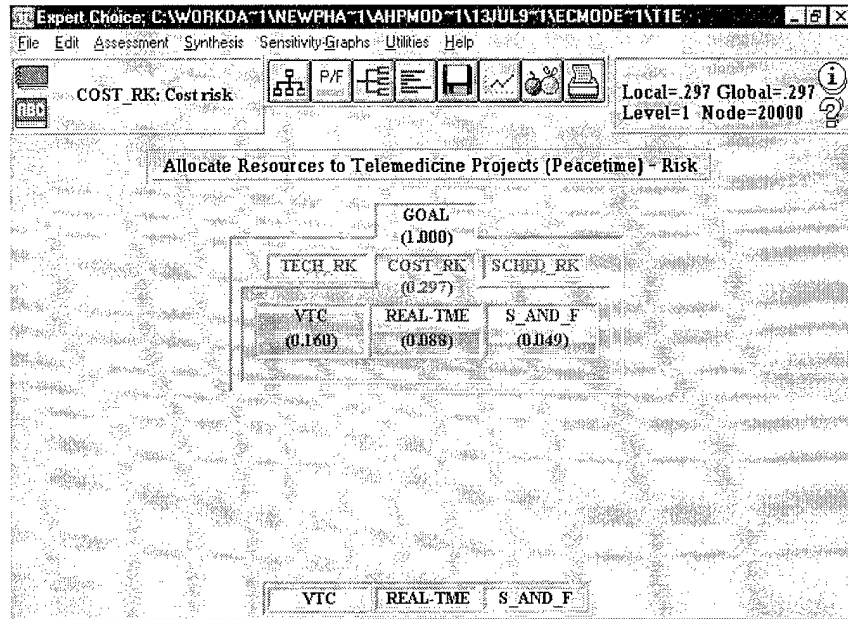
Figure 49 EC Model #5 Cost Risk Objective Global Weights (Peacetime)
(which shows EC Model #5 Cost risk objective global weights for peacetime)
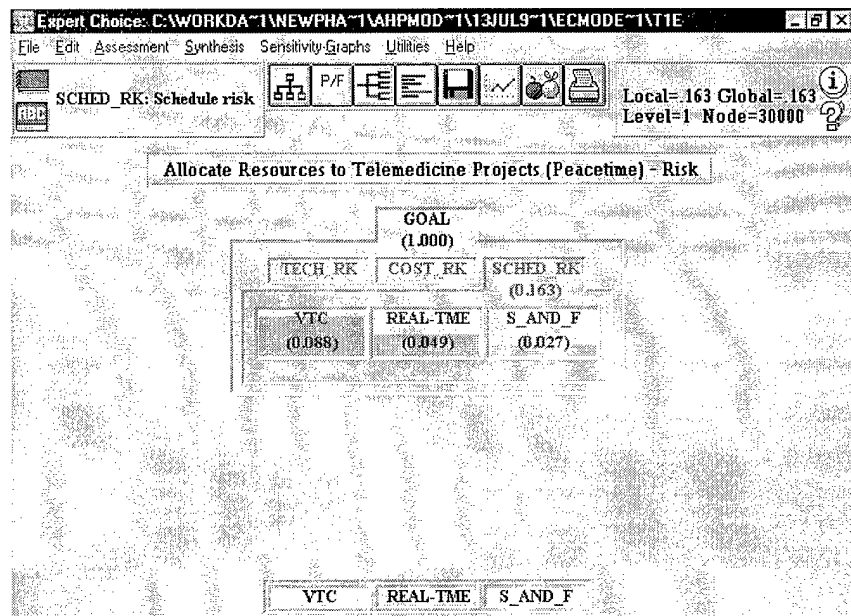
Figure 50 EC Model #5 Schedule Risk Objective Global Weights (Peacetime)
(which shows EC Model #5 Schedule risk objective global weights for peacetime)

6.8.6 RATINGS MODEL

Now that the global weights have been derived, the benefit, cost, and risk models may be used to evaluate the various initiatives. Since there is insufficient data from data collection, four simulated VTC Projects (VTC Project A, B, C, and D) were analyzed using the telemedicine assessment tool. Figure 51 shows the sample entries for a benefit ratings model for VTC Project A with respect to Compatibility.

Figure 51 Sample VTC Ratings Model for Benefits
(which shows the evaluation of sample VTC Projects using benefit objectives)

Similarly, each initiative may be evaluated using the associated intensity levels. The ratings model automatically calculates the total weights (under the TOTAL heading). In addition, the cost of each of the projects may also be added in an addition column (COST) which is not shown above. The complete simulated data for sample VTC Projects A-D is shown in Table 14.

ALTERNATIVE	TOTAL	COMPATBL	RELIABLE	PERFORM	STANDRDS	UPGRADE
VTC Project A	0.819	H_Compat	H_Reliab	E_Perfm	A_Std	Ease_UG
VTC Project B	0.532	M_Compat	M_Reliab	G_Perfm	M_Std	Ease_UG
VTC Project C	0.321	B_Compat	B_Reliab	A_Perfm	S_Std	M_UG
VTC Project D	0.224	N_Compat	N_Reliab	B_Perfm	N_Std	N_UG

ALTERNATIVE	SPEED	MULT USE	EASE USE	POLITICL	USGE_LVL	PATIENT
VTC Project A	T1	M4_USE	V_Easy	H_Supprt	H_Used	AD_PT
VTC Project B	ISDN	3_USE	M_Easy	M_Supprt	M_Used	DEP_PT
VTC Project C	Telephn	2_USE	N_Easy	M_Supprt	A_Used	RET_PT
VTC Project D	S_Modems	S_USE	VD_Easy	N_Supprt	B_Used	OTHER_PT

ALTERNATIVE	INTEGRTE	MOP	PLAN	QUALITY	EFFICNCY	SAFETY
VTC Project A	F_Integr	Y_MOP	Y_Plan	HI_Qual	MI_Effic	AS_Safe
VTC Project B	F_Integr	Y_MOP	N_Plan	MI_Qual	BI_Effic	AS_Safe
VTC Project C	D_Integr	N_MOP	N_Plan	BI_Qual	BI_Effic	N_Safe
VTC Project D	N_Integr	N_MOP	N_Plan	NI_Qual	NI_Effic	N_Safe

ALTERNATIVE	APPROVL	SATISF	SECURE			
VTC Project A	OG_Appr	M_Sat	B_Secure			
VTC Project B	N_Appr	M_Sat	U_Secure			
VTC Project C	N_Appr	B_Sat	U_Secure			
VTC Project D	N_Appr	U_Sat	U_Secure			

Table 14 Simulated Benefit Ratings data for VTC Projects
(which shows an evaluation of sample VTC Projects using benefit objectives)

Similarly, the VTC Projects may be evaluated using the cost and risk models shown below.

Figure 52 Sample VTC Ratings Model for Cost (Peacetime)
(which shows the evaluation of sample VTC Projects using cost objectives)

ALTERNATIVE	TOTAL	MAINTAIN	SIZE	WEIGHT	ASSMBLY	CUSTOM
VTC Project A	0.371	L_Maintn	Neg_Sz	VL_Wt	E_Asmbly	COTS/GOT
VTC Project B	0.404	A_Maintn	Port_Sz	L_Wt	E_Asmbly	ENH_COTS
VTC Project C	0.522	M_Maintn	Port_Sz	A_Wt	M_Asmbly	ENH_COTS
VTC Project D	0.697	H_Maintn	Fixed_Sz	Mod_Wt	D_Asmbly	CUS_EQ
ALTERNATIVE	ICAPITAL	OCAPITAL	TRAINING	FACILITY	SCHEDUL	TRANS$
VTC Project A	VL_ICAP	S_OCAP	S_Trng	Ded_Fac	N_Sched	M_Transm
VTC Project B	L_ICAP	M_OCAP	A_Trng	L_FloorS	N_Sched	M_Transm
VTC Project C	M_ICAP	L_OCAP	M_Trng	M_FloorS	Y_Sched	L_Transm
VTC Project D	S_ICAP	VL_OCAP	L_Trng	S_FloorS	Y_Sched	L_Transm
ALTERNATIVE	DISCMFT	P_INCONV	C_INCONV	DELAY	MOVEMNT	CONFINE
VTC Project A	L_Discmf	M_PIConv	S_CIConv	S_Delay	L_Move	S_Confn
VTC Project B	L_Discmf	M_PIConv	S_CIConv	S_Delay	L_Move	L_Confn
VTC Project C	S_Discmf	S_PIConv	S_CIConv	S_Delay	S_Move	L_Confn
VTC Project D	S_Discmf	S_PIConv	S_CIConv	S_Delay	M_Move	L_Confn

Table 15 Simulated Cost Ratings data for VTC Projects
(which shows the evaluation of sample VTC Projects using cost objectives)

Figure 53 Simulated Risk Ratings for VTC Projects
((which shows the evaluation of sample VTC Projects using risk objectives)

In Summary, the simulated VTC Projects have the following total weightings:

PROJECTS	BENEFIT	COST	RISK
VTC Project A	0.819	0.371	0.132
VTC Project B	0.532	0.404	0.206
VTC Project C	0.321	0.522	0.354
VTC Project D	0.224	0.697	0.582

Table 16 Summary of simulated weights
(which shows the relative weights for the sample VTC Projects)

6.8.7 Resource Allocation Application

COST-BENEFIT ANALYSIS

A cost-benefit analysis may now be performed using the equation:

$$f = \frac{Benefit}{Cost}$$

And a cost-benefit-risk analysis may use the equation:

$$f = \frac{Benefit}{Cost * Risk}$$

PROPJECTS	Benefit/Cost	Benefit-Cost-Risk	Ranking
VTC Project A	2.208	16.724	1
VTC Project B	1.317	6.392	2
VTC Project C	0.615	1.737	3
VTC Project D	0.321	0.552	4

Table 17 Simulated project analysis and ranking
(which shows the results of cost-benefit, benefit-cost-risk analysis)

If the actual initial investment for the VTC Projects are:

VTC Project A	$500,000
VTC Project B	$350,000
VTC Project C	$250,000
VTC Project D	$100,000

The efficiency frontier may be plotted. The efficiency frontier has the values of total cost ($) on the horizontal axis and the cumulative Benefit/Cost Ratio on the vertical axis. See Figure 54 for the efficiency frontier for the sample VTC projects.

Sample Efficiency Frontier

Cumulative B/C Ratio

Series 1	500	850	1100	1000
	2.2075	3.5244	4.1393	4.4607

Cumulative $ (Millions)
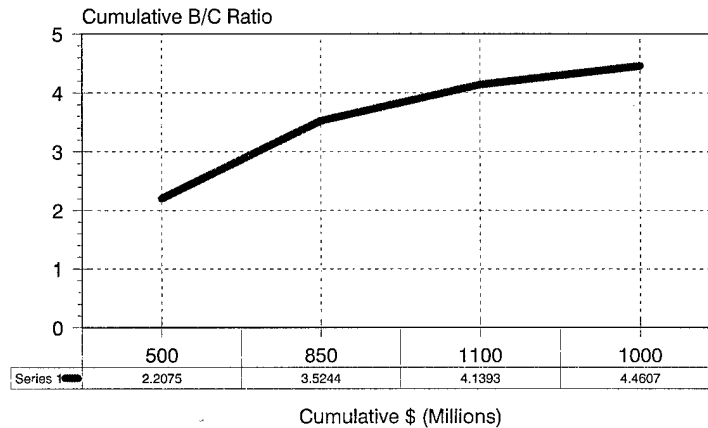
Figure 54 Simulated Efficiency Frontier
(which shows the simulated efficiency frontier for the VTC Projects)

MAXIMIZATION OF BENEFITS - OPTIMIZATION

The solver tool in Microsoft's EXCEL may be used to find the combination of projects or activities that maximizes the total benefits without exceeding the budget. This problem can be formulated as a zero-one integer mathematical programming problem, sometimes referred to as a knapsack problem. Mathematically, the optimization problem in this simulation is as follows:

Maximize $.819X_1 + .532X_2 + .321X_4 + .224X_4$ (Benefits)

Subject to $.371X_1 + X_2 + X_4 + 0.697X_4 < \$1M$ (Cost)

Note: $1M is the total budget (Constraint)

where $X_1, X_2, X_4,$ and $X_4 > 0$
and $X_1, X_2, X_4,$ and $X_4 > 1$
and $X_1, X_2, X_4,$ and X_4 are integers.

Therefore, VTC Projects A, B, should be funded if the sample total budget is $1M. Other budget levels resource allocation may be easily generated using this technique as well.

7. FINDINGS

7.1 VIRTUALLY NO TELEMEDICINE SYSTEMS WERE OPERATIONAL AT THE TIME OF REL DATA COLLECTION.

During the period of data collection, January 2, 1998 to March 31, 1998, TRICARE Region 6 experienced difficulty in bringing the dial-anywhere capability on-line. In fact, shortly after the transition from the old to new BAMC, the telemedicine communications infrastructure had experienced numerous difficulties, including service interruptions, which undermined the clinical reliability of the system. At the time of the data collection, only the VTC applications and the directly connected lines (without routing through the TELEOS switch) were in operation.

Complaints were also noted regarding the difficulty in employing the mobile telemedicine units because of their large and cumbersome configuration, long set-up time and inaccessible operational controls especially for the clinical staff when trying to use them. Technical staff members were very industrious in their attempts to troubleshoot the malfunctioning of a system, which they had previously issued by force. Some of the "Store-and-Forward" systems in radiology and pathology were being used by DACH and BAMC personnel and were regarded as helpful; however, no recorded data was available to support their effectiveness. Other telemedicine applications such as administrative teleconferencing and educational tutorial link-ups with local educational institutions were regarded by many of the interviewees as very positive and beneficial; however, the benefits were not quantified.

7.2 THERE WAS NOT MUCH DATA AVAILABLE AND WHAT WAS AVAILABLE WAS NOT WHAT WAS NEEDED.

"Although there are many individuals who believe strongly in the potential for telemedicine to provide timely and cost-effective support, little "hard data" is available to support that belief." This statement, from the Joint Working Group on Telemedicine (JWGT) in January 1997, still applies at the finalization of the REL report concerning the initiatives in Region 6. The inability of the telemedicine support systems to perform reliably contributed adversely to the data collection and tracking within the Region. Even the administrative VTC and other working telemedicine initiative such as tele-education did not have meaningful data recorded to assess effectiveness. While some TV tapes were available, no analysis of content and relevance had been done.

At the MEDNET, the center of the telemedicine DS-3 network in the Region, REL found partial data including network load capacity, security related information and call duration reports. Although the call duration reports are

valuable for showing the origination and termination of every call from a node, the connection time and duration of the call, the collection reports do not indicate the clinical or administrative content or value. In other words, the report indicates calls occurring from the radiology department but does not indicate the nature of the clinical or non-clinical activity.

There is a clear need for both quantitative and qualitative "hard data" to be systematically gathered over time to show telemedicine clinical effectiveness and supportability against the AMEDD success criteria. This data, when captured and applied to the AHP Expert Choice software will help shape informed, pragmatic decisions. It is apparent from Section 6 of this report concerning data collection, that the statement of Dr. Ernest H. Foreman applies, "The data we have is not what we need. The data that we need is not what we have"[47]. To help develop a comprehensive and supportable solution, clinical users must be involved in the development of the data collection plan and collection profile to insure that they make sense to them as users as well as efficiently capturing the necessary data with the minimum disruption and additional work.

7.3 IT WAS DIFFICULT TO DETERMINE RELATIVE IMPORTANCE AND WEIGHTING FACTORS NEEDED TO EVALUATE THE AMEDD INITIATIVES IN REGION 6.

The general lack of pertinent data also contributed to the problem of determining relative preference, importance, and value. It was unclear from the lack of AMEDD administrative documentation of what were the individual initiative's objectives and measures of performance. Hence, it was not possible analytically to determine which objectives were important and by how much. The founding vision of "The hospital without walls" does not provide the specificity to support the input parameters needed to assess the initiatives using the AHP assessment tool.

Moreover, the 31-telemedicine initiatives were not a result of a prioritization process to identify relative weightings essential for meaningful inputs to the AHP decision support process. As described in a number of site interviews at DACH and BAMC, the final decision for past telemedicine equipment purchases may have been dictated by the promotional persuasions of the vendor done at higher headquarters rather than with the actual clinician user. Therefore, it is difficult to extract from data collection, which of the objectives were truly important since the original recommendations for vendor selection and capabilities were not provided. What was clear was a universal unhappiness with the fielded system.

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[47] REL interview with Dr. Ernest H. Forman at his George Washington University office, 10 JUN 98

REL also observed that clinicians had a hard time reaching judgments about what factors were more important which is a typical issue with decision-making problem sets. For example, some did not want to clearly state that the system reliability factors are more important than the system performance. And if so, by how much? However, the information concerning the importance of clinical convenience may be inferred from statements such as "Even if it (the system) worked, I wouldn't use it because of the inconvenience of having to schedule the sessions." Although REL gathered a few of these anecdotal statements during the on-site interviews, there was clearly not enough information to derive the weights for entry into the assessment tool. The overall lack of quantifiable, weighted data precluded the application of the AHP assessment tool.

7.4 THERE IS NO UP-TO-DATE, COMPREHENSIVE AND DOCUMENTED BUSINESS PLAN FOR REGION 6.

DACH did develop a partial telemedicine business plan (see Appendix N) which was the only available published plan. While it represents a very useful first step, the plan falls short of being a complete roadmap since it did not include a detailed needs assessment and market situation analysis, business strategy, marketing strategy, operational strategy, organizational structure and financial strategy necessary to rationally drive the next steps. However, there is clear evidence that considerable "hands-on" expertise exists in Region 6 to help develop a business plan. The initial investment in developing a good business plan based on AHP will be essential to the follow-on years of telemedicine research, development and implementation as well as being responsive to the concerns pointed out in the GAO Telemedicine Report[48].

7.5 THE 31 INITIATIVES WITHIN REGION 6 ARE UNFOCUSED AND DID NOT HAVE INDIVIDUAL PROJECT MANAGEMENT PLANS.

The individual initiatives did not have a clear project management focus and lines of responsibility to implement the initial vision. In fact, it was difficult to determine the cornerstones of project management e.g. the mission, the objectives, the measures of performance, the milestones, and the constraints (time, schedule, and cost). Therefore, it was difficult to identify the documented analyses of benefits as well as the costs and associated risks. Moreover, the lack of an operative cost accounting system made the financial tracking of each initiative impossible. A project management plan is essential in determining the AMEDD value for each initiative as well as for comparison among initiatives.

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[48] GAO Report.

7.6   TELEMEDICINE INFORMATION IS BEING SHARED WITHIN REGION 6.

The telemedicine working group, chaired by LTC Darryl Zeigler conducts meetings on a monthly basis with representatives from across the Region to discuss telemedicine issues. These sessions are helpful not only in discussing current issues but also provide a forum for problem identification and potential resolution. These meetings represent a positive means for informal data collection, knowledge management, and professional communication. Also, the working group notes can certainly serve as pre-marketing insights for future business planning in the region. These meetings are well attended and clearly demonstrate commitment by the concerned clinician professionals to finding constructive and affordable telemedicine solutions for Region 6.

7.7   THERE IS CLINICIAN INTEREST IN LEVERAGING TELEMEDICINE AND INFORMATION TECHNOLOGY TO ENHANCE QUALITY AND EFFICIENCY OF CARE WITH USERS LOOKING FORWARD TO A MEANINGFUL ROLE IN THE DECISION PROCESS FOR THE ADOPTION OF FUTURE TECHNOLOGY APPLICATIONS.

A REL lesson learned is that for any new technology, selected, purchased and then taken out of the box, still requires a certain level (sometimes moderate to extensive) technical support which can be a heavy burden on the existing staff if not adequately planned and properly resourced. Even though personnel in Region 6 have had negative experiences with previous telemedicine projects, there is still strong interest expressed during site interviews in leveraging not only the promise of telemedicine but also more broadly information management technology to enhance efficiency and quality of care in the face of shrinking resources. The following example demonstrates a potential application:

> A psychiatrist at DACH proposed to project the medical expertise out from regional centers via remote access to soldiers and families at Ft. Hood, Texas and Ft. Leavenworth, Kansas. He spoke of the tremendous opportunity to meet the need for conducting remote psychiatric crisis interventions from Fort Hood to Fort Leavenworth via a low-cost desktop video phone which would help offset cutbacks in the hiring of psychiatrists while the incidence of crises situations involving drug abuse, marital conflict, family separation anxiety and sexual harassment continues to rise.

The psychiatrist believed that a low-cost teleconsultation system ($500.00) would provide the means for timely clinician access to the person in crisis. He further observed that the existing telemedicine infrastructure was a negative capability since it required too much setup time and was extremely unwieldy to move around the hospital. REL observed that clinicians work extremely hard to keep up with their burgeoning patient load and were naturally hesitant to adopt any new practice, which could end up being an additional burden. This was particularly true if an old and new system would have to be maintained concurrently, especially without the proper training and technical and maintenance support for either system. The clinicians made it clear that they wanted to be involved in the decision process for future technological applications.

8.0 RECOMMENDATIONS

8.1 CONDUCT SPECIFIC DECISION-MAKING SESSIONS SUPPORTED BY AN AHP EXPERT CHOICE TOOL TO VERIFY THE PRELIMINARY TELEMEDICINE OBJECTIVES WITH THE PURPOSE OF SYNTHESIZING RELATIVE PRIORITIES AND WEIGHTS TO SUPPORT THE AHP MODEL.

To be meaningful, these sessions must be conducted with decision-makers and the clinician practitioners of telemedicine to address the different clinical domains and their support functions across the AMEDD so that a comprehensive profile of the potential application of telemedicine can be determined.

8.2 INITIATE DATA COLLECTION WITHIN REGION 6 TO SUPPORT THE AHP MODEL DATA INPUT.

Employing the REL Technology Profile, clinical domains and associated administrative and technical support staff and clinical users must be queried in order to complete and refine the data collection to support the AHP. Coordination is needed with the MEDNET NOD so that all telemedicine activities eventually exported to the other Regions, such as pathology and radiology, can be monitored and assessed. Although the focus of the analysis should be on Region 6, the implicit advantage of telemedicine is its ability to distribute clinical activity throughout the AMEDD in real-time or by store and forward means. The capture of qualitative and quantitative data is the required input necessary to synthesize the AHP model.

8.3 RE-EVALUATE EXISTING TELEMEDICINE EQUIPMENT WITHIN THE REGION TO ASSESS EFFECTIVENESS FOR CURRENT AND FUTURE NEEDS AND WITH CLINICIANS PARTICIPATING FULLY IN THE EVALUATION PROCESS.

After the 22 mobile NEC telemedicine units are operational, a timely and comprehensive evaluation of all the telemedicine systems should be conducted to assess effectiveness from both the patient and clinician's perspective as well as the service supporter. Vendor involvement must be minimized in the assessment to determine true cost-benefit-risk as criteria for the AHP model.

8.4 ADOPT A PROJECT MANAGEMENT FOCUS AT THE INITIATIVE LEVEL.

A consistent standard of project management tools for organization, concepts and documentation should be applied to ensure that business models meet the clinician and decision-makers needs. Standard methodology of project management planning with the constraints of cost, schedule, performance, milestones and deliverables should implemented. Project management involvement should begin at inception and continue throughout the life of the entire project.

8.5 CONDUCT PERIODIC PROJECT AUDITS TO ASSESS THE RETURN-ON INVESTMENT AND CAPTURE LESSONS LEARNED FOR LONG-TERM IMPROVEMENT WITHIN THE REGION.

This control and feedback function is also critical to the overall stewardship of the project leading to success in implementing effective and affordable solutions for the AMEDD community long-term. To be sustainable and supportable, user input must be clearly communicated, documented and used to shape the program. Adjustments to any plan are inevitable but to be timely and meaningful, decisions must be based on accurate data. This approach is tantamount to building a supportable infrastructure for informed decision-making.

8.6 DEVELOP AN OVERARCHING AMEDD TELEMEDICINE BUSINESS PLAN FOR REGION 6 BASED ON APPLICATION OF THE AHP MODEL:
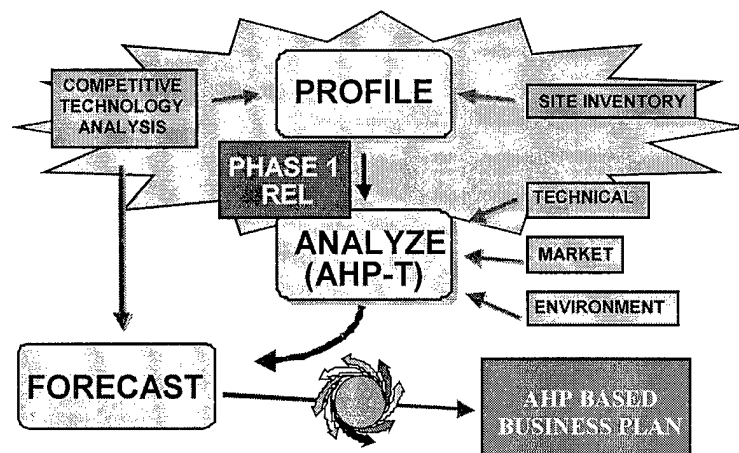
The AHP model based business plan will provide Region 6 decision-makers a tool on which to develop informed judgements for both short-term and long-term investments in advanced technologies and the adoption of commercial business practices for the region.

APPENDIX A

AHP THEORY

BASIC THEORY OF THE ANALYTIC HIERARCHY PROCESS[1]

1. Introduction

When one speaks of relative measurement, those of us trained in the physical sciences and in mathematics are likely to think of measuring things. For example, on a scale such as the yard or the meter, each with its units, we divide the corresponding lengths to get the relative lengths. But that is not what I mean by relative measurement. First I ask what should I do if I did not have a scale to measure length to define the relative length of two objects?

When we have no standard scales to measure things absolutely, we must make comparisons and derive relative measurements from them. The question is how, and what we have learned in this process.

We should note that we are not talking about a proposed theory that we can accept or reject. Comparisons leading to a relative measurement is a talent of our brains. It has been neglected in science because we have not learned to formalize it in harmony with the usual way of creating standard scales and comparing things one at a time.

The cognitive psychologist Blumenthal[2] writes:

"Absolute judgement is the identification of the magnitude of some simple stimulus..., whereas comparative judgement is the identification of some relation between two stimuli both present to the observer. Absolute judgement involves the relation between a single stimulus and some information held in short-term memory – information about some former comparison stimuli or about some previously experienced measurement scale ... To make the judgement, a person must compare an immediate impression with impression of similar stimuli..."

Thus relative measurement through comparative judgement is intrinsic to our thinking and should not be carried by as an appendage whose real function is not understood well or at all and should be kept outside. It is not difficult to see that relative measurement predates and is necessary for creating and understanding absolute measurement. Some of the work reported here is now well know. But we need it for the subsequent discussion that lays the foundation for relative measurement.

2. The Paradigm Case; Consistency

We will first show that when the judgements used measurements from a scale to form the ratios, the resulting matrix is consistent and deriving the scale is an elementary but fundamental operation. Later we generalize to the inconsistent case where the numerical values of the

[1] Thomas L. Saaty, Fundamentals of Decision Making and Priority Theory with the Analytic Hierarchy Process, Volume VI, RWS Publications, Pittsburgh, PA, 1995, Chapter 2, pp. 45-92
[2] Blumenthal, A.L., 1977, The Process of Cognition, Prentice Hall.

judgements are not taken from precise measurements but are ratios estimated according to knowledge and perception.

Let us assume that n activities are being considered by a group of interested people and that their tasks are

a.   to provide judgements on the relative importance of these activities, and
b.   to ensure that the judgements are quantified to an extent that permits a quantitative interpretation of the judgements among all activities

Our goal is to describe a method for deriving, from these quantified judgements (i.e., from the relative values associated with <u>pairs</u> of activities), a set of weights to be associated with <u>individual</u> activities in order to put the information resulting from a and b into usable form.

Let $A_1, A_2, ..., A_n$ be the activities. The quantified judgements on pairs of activities (A_i, A_j) are represented by an n-by-n matrix

$$A = (a_{ij}), (i, j = 1, 2, ..., n)$$

The problem is to assign to the n activities, $A_1, A_2, ..., A_n$ a set of numerical weights $w_1, w_2, ..., w_n$ that reflect the recorded quantified judgements.

First we get a simple question out of the way. The matrix **A** may have several, or a few, non-zero entries a_{ij} Zeros are used when the judgements is unavailable. The question arise: how many entries are necessary to ensure the existence of a set of weights that is meaningful in the context of the problem? The answer is: it is sufficient that there be a set of entries that interconnects all activities in the sense that for every two indices, i, j, there should be some chain of (positive) entries connecting i with j:

$$a_{i_1 i_1}, a_{i_1 i_2}, a_{i_2 i_3}, ..., a_{i_k j}$$

Note that a_{ij} itself is such a chain of length l. (Such a matrix $A = (a_{ij})$ corresponds to a strongly connected graph.) This gives precise meaning to the formulation of task b.

One of the most important aspects of AHP is that it allows us to measure the overall consistency of the judgements a_{ij}. An extreme example of inconsistent judgement is if we judge one activity to be more important than another and the second more important than the first, $a_{ij} > 1$ and $a_{ji} > 1$. More subtle is the case when the judgements of the three alternatives are not "transitive." We might judge one stone two times as heavy as the first, a third stone twice as heavy as the second, but the first and last to be of equal weights. In that case $a_{ij} \neq a_{ik} a_{kj}$. This example leads us to the

Definition - **A** $= (a_{ij})$ is consistent if:

$$a_{ij} a_{jk} = a_{ik} \quad \text{where } i, j, k = 1, 2, ... n$$

We see that such a matrix can be constructed from a set of n elements which form a chain (or more generally, a spanning tree, a connected graph without cycles that include all n elements its vertices) across the rows and columns.

To interpret our first theorem let us consider the following case. An adult and a child are compared according to their height. If the Adult is estimated to be two and a half times taller that may be demonstrated by marking off several heights of the child end to end. However, if we have an absolute scale of measurement with the child measuring w_1 units and the adult w_2 units, then the comparison would assign the adult the relative value w_2/w_1 and the child w_1/w_2 the reciprocal value. These ratios also give us the paired comparison values $(w_1/w_2)/1$ and $1/(w_2/w_1)$ respectively, in which the height of the child serves as the unit of comparison. Such a representation is valid only if w_1 and w_2 belongs to a ratio scale so that the ratio w_1/w_2 is independent of the unit used, be it in inches or in centimeters, for example. In this way, we can interpret all ratios as absolute numbers or dominance units.

Let us now form the matrix W whose rows consist of the ratios of the measurements w_i of each n items with respect to all others.

$$ W = \begin{pmatrix} w_1/w_1 & w_1/w_2 & \ldots & w_1/w_n \\ w_2/w_1 & w_2/w_2 & \ldots & w_2/w_n \\ \vdots & \vdots & \vdots & \vdots \\ w_n/w_1 & w_n/w_2 & \ldots & w_n/w_n \end{pmatrix} $$

It is easy to prove:

Theorem 2.1 - *A positive n by n matrix has the ratio form $A = (w_i/w_j), i,j = 1,\ldots n$ if, and only if, it is consistent.*

Corollary If 2.1 is true, then **A** is reciprocal.

We observe that if W is the matrix above and w is the vector $w = (w_1, \ldots w_n)^T$ then $Ww = nw$. This suggests

Theorem 2.2 - *The matrix of ratios $A = (w_i/w_j)$ is consistent if and only if n is its principal eigenvalue and $Ww = nw$. Further $w > 0$ is unique to within a multiplicative constant.*

Five conditions on A for Preserving Order

A weaker condition for preservation than

(i) $(A)_i \geq (A)_j$ implies $w_i \geq w_j$

is,

(ii) $\qquad$ $(Ae)_i \geq (Ae)_j \qquad$ implies $w_i \geq w_j$

where $(A)_i \geq (A)_j$ denote the ith row and jth row sum of **A**, and its generalization to powers of A given in the normalized form:

(iii) $\qquad$ $\dfrac{(A^m e)_i}{e^T A^m e} \geq \dfrac{(A^m e)_j}{e^T A^m e} \qquad$ implies $w_i \geq w_j$

The condition for order preservation must include all powers of **A**, and is given here in terms of their sum. For sufficiently large integer N>0, and for $p \geq n$

(iv) $\qquad$ $\displaystyle\sum_{m=1}^{p} \dfrac{(A^m e)_i}{e^T A^m e} \geq \sum_{m=1}^{p} \dfrac{(A^m e)_j}{e^T A^m e} \qquad$ implies $w_i \geq w_j$

and by (2):

(v) $\qquad$ $\displaystyle\lim_{p\to\infty} \dfrac{1}{p}\sum_{m=1}^{p} \dfrac{(A^m e)_i}{e^T A^m e} \geq \lim_{p\to\infty} \dfrac{1}{p}\sum_{m=1}^{p} \dfrac{(A^m e)_j}{e^T A^m e} \qquad$ implies $w_i \geq w_j$

Theorem 2.3 *If A is consistent, then*

$$\lim_{p\to\infty} \frac{1}{p}\sum_{m=1}^{p} \frac{(A^m e)_i}{e^T A^m e} \to c w_i > 0$$

And (i) – (v) are true

3.　Small Perturbations and Ratio Scale Approximation

Because we are interested in the construction of an appropriate matrix W of ratios that serve as a "good" approximation to a given reciprocal matrix A, we begin by assuming that A itself is a perturbation of W. We need the following kind of background information.

For an unrepeated eigenvalue of a positive matrix A it Is known[3,4,5] that a small perturbation A(ε) of A gives rise a perturbation $\lambda(\varepsilon)$ that is analytic in the neighborhood of $\varepsilon = 0$ and small because A(ε) is reciprocal. The following theorems give us a part of what we need.

[3] Lancaster, P., and Miron Tismenetsky, 1985, "Linear Transformations and Matrices," The Theory of Matrices Second Edition: With Applications, Academic Press, Inc., Orlando

[4] Stewart, G. W., 1973, "Eigenvalues and Eigenvectors," Introduction to Matrix Computations, Academic Press, Inc. Orlando

[5] Wilkinson, J.H., 1965, The Algebraic Eigenvalue Problems, Clarendon Press, Oxford

Theorem 2.4 (Existence): *If λ is a simple eigenvalue of A, then for small $\varepsilon > 0$, there is an eigenvalue $\lambda(\varepsilon)$ with power series expansion in ε:*

$$\lambda(\varepsilon) = \lambda + \varepsilon\lambda^{(1)} + e^2\lambda^{(2)} + \cdots$$

And corresponding right and left eigenvectors $\omega(\varepsilon)$ and $\upsilon(\varepsilon)$ such that

$$w(\varepsilon) = w + \varepsilon w^{(1)} + \varepsilon^2 w^{(2)} + \cdots$$

$$\upsilon(\varepsilon) = \upsilon + \varepsilon\upsilon^{(1)} + \varepsilon^2\upsilon^{(2)} + \cdots$$

Let θ_{ij} be a perturbation of a reciprocal matrix $\mathbf{A}$ such that $B = (a_{ij} + \theta_{ij})$ is also positive[6].

Theorem 2.5 *If a positive reciprocal matrix A has the eigenvalue $\lambda_1, \lambda_2, \cdots, \lambda_n$ where the*

multiplicity of m_j is λ_j with $\sum_{j=1}^{n} m_j = n$, then given $e > 0$ there is a $\delta(e) > 0$ such that

if $\left| a_{ij} + \theta_{ij} - a_{ij} \right| \leq \delta$ for all i and j the matrix $\mathbf{B}$ has exactly m_j eignvalues in the circle

$\left| \mu_j - \lambda_j \right| < \varepsilon$ for each $j=1,2,...,s$ where $\mu_1, \mu_2, \cdots, \mu_s$ are the eigenvalues of $\mathbf{B}$.

If $\mathbf{A}$ is a consistent matrix, then it has one positive eigenvalue $\lambda_1 = n$ and all other eigenvalues are zero. For a suitable $\varepsilon > 0$ there is a $\delta(\varepsilon) > 0$ such that for $\left| \theta_{ij} \right| < \varepsilon$ the perturbed matrix $\mathbf{B}$ has one eigenvalue in the circle $\left| \mu_1 - n \right| < \varepsilon$ and the remaining eigenvalues fall in a circle $\left| \mu_j - 0 \right| < \varepsilon$ $j=2,3,...,n$.

Theorem 2.6 *If n is a simple eigenvalue of A which dominates the remaining eigenvalues in modulus, for sufficiently small ε, $n(\varepsilon) \equiv \lambda_{max}$ dominates the remaining eigenvalues of $A(\varepsilon)$ in modulus.*

When $\mathbf{A}$ is inconsistent, several conditions on a_{ij} and on w_i along with uniqueness, must be met to enable us to approximate $\mathbf{A}$ by ratios. Our conditions are divided into two categories. One category deals with the order induced by a_{ij} as absolute numbers $(w_i / w_j)/1$ or $1/(w_j / w_i)$ from a standard scale, on the components of the scale w. The other category deals with the equality or near equality of the a_{ij} to the ratio (w_i / w_j) formed from the derived scale w.

When $\mathbf{A}$ is inconsistent, how do we construct $\mathbf{W}$ so that the order preservation condition (v) still holds? Later we address the other question; what conditions must $\mathbf{A}$ satisfy to ensure that (w_i / w_j) is a "good" approximation to a_{ij}?

Let us consider estimates of ratios given by an expert who may make small perturbations

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[6] Franklin, J.N., 1968m "Matrix Theory," Prentice-Hall, Englewood Cliffs, NJ.

ε_{ij} in $W = (w_i / w_j)$. Comparisons by ratios allow us to write $a_{ij} = (w_i / w_j)\varepsilon_{ij}$, $e_{ij} > 0$ i, j = 1, 2, ..., n. In that case, $\mathbf{A}$ takes the form $\mathbf{A} = \mathbf{W} \circ \mathbf{E} = \mathbf{DED}^{-1}$ where $W = (w_i / w_j)$, $E = (\varepsilon_{ij})$, $\mathbf{D}$ a diagonal matrix with w as diagonal vector and 'o' refers to the Hadamard or element wise product of the two matrices. The principal eigenvalue of A coincides with that of $\mathbf{E}$. The principal eigenvector of $\mathbf{A}$ is the element wise product of the principal eigenvectors $w = (w_1, w_2, ..., w_n)^T$, and $e = (1, ..., 1)^T$ of and of $\mathbf{E}$ respectively[7].

The distinction we make between an arbitrary positive matrix and a reciprocal matrix is that we can control a step by step modification of a reciprocal matrix so that in the representation $\mathbf{A} = \mathbf{W} \circ \mathbf{E} = \mathbf{DED}^{-1}$, the i, j = 1, 2, ..., n are small. The purpose is to ensure that the perturbing the principal eigenvalue and eigenvectors of $\mathbf{W}$ yields the principal eigenvalue and eigenvector of $\mathbf{A}$.

Why do we need such perturbations? Because we assume that there is an underlying ratio scale that we attempt to approximate. By improving the consistency of the matrix, we obtain an approximation of the underlying scale by the principal eigenvector of the resulting matrix.

Theorem 2.7 *w is the principal eigenvector of a positive matrix A if, and only if, $Ee = \lambda_{max} e$.*

Note that e is the principal eigenvector of $\mathbf{E}$ and $\mathbf{E}$ is a perturbation of the matrix $e^T e$. When $Ee \neq \lambda_{max} e$ the principal eigenvector of $\mathbf{A}$ is another vector $w' \neq w$ and $A = W' \circ E'$ where $E'e = \lambda_{max} e$.

Corollary w is the principal eigenvector of a positive reciprocal matrix $\mathbf{A} = \mathbf{W} \circ \mathbf{E}$, if and only if, $E'e = \lambda_{max} e$ and $e_{ji} = (e_{ij})^{-1}$.

Theorem 2.8 *(order preservation): A positive matrix A satisfies condition (v), if and only if, the derived scale w is the principal eigenvector of A, i.e., $Aw = \lambda_{max} w$.*

4. Four Conditions for Good Approximations

1) Reciprocity

   The reciprocal condition is a local relationship between pairs of elements: $a_{ji} = 1 / a_{ij}$ needed to ensure that, as perturbations of ratios a_{ij} and a_{ji} can be approximated by ratios from a ratio scale that are themselves reciprocal. It is a necessary condition for consistency.

2) Homogeneity – Uniformly Bounded Above and Below

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[7] Vargas, L. G., 1983, "Analysis of Sensitivity of Reciprocal Matrices," Applied Mathematics and Computation 12, pp. 301-320, Elsevier Science Publishing Co., Inc., New York.

Homogeneity is also a local condition on each a_{ij}. To ensure consistency in paired comparisons, the elements must of the same order or magnitude which means that our perceptions in comparing them, should be of nearly the same order of magnitude. Thus we require that the a_{ij} be uniformly bounded above and by a positive constant K and, because of the reciprocal condition, they are automatically uniformly bounded below away from zero:

$$1/K \le a_{ij} \le K, \quad K > 0, \quad i,j = 1,2,...n.$$

It is a fact that people are unable to directly compare widely disparate objects such as an apple and a watermelon according to weight. It they are not comparable, it should be possible to aggregate them in such homogenous clusters to make the comparisons. For example, we put the apple with a grapefruit and a cantaloupe in one cluster, then the cantaloupe again, a honeydew melon and varying sizes of watermelons in another cluster. The relative measurements in the clusters can be combined because we included the largest element (the cantaloupe) in the small cluster as the smallest element of the adjacent large cluster. Then the relative weights of the elements in the second cluster are divided by the relative weights of the common element and multiplied by its relative weight in the smaller cluster. In this manner, relative measurement of the elements in the two clusters can be related and the two clusters combined after obtaining relative measurement by paired comparison in each cluster. The process is continued from cluster to adjacent cluster.

3) Near Consistency

The near consistency condition is global, is formed in terms of the (structural parameters) λ_{max} of n and of **A** and **W**. It is a less familiar and more intricate condition that we need to discuss at length. The requirement that comparisons be carried out on homogeneous elements ensure that the coefficients in the comparison matrix are not too large and generally of the same order of magnitude, i.e., from 1 to 9. Knowing this constrains the size of the perturbations ε_{ij}, whose sum as we shall see below, is measured in terms of the near consistency condition $\lambda_{max} - n$.

The object then is to apply this condition to develop algorithms to explore changing the judgements and their approximation by successively decreasing the inconsistency of the judgements and then approximating them with ratios from the derived scale. The simplest such algorithm is one which identifies that a_{ij} for which $a_{ij} w_j / w_i$ is maximum and indicates decreasing it in the direction of w_i / w_j. Another algorithm due to Harker[8] utilizes the gradient of the a_{ij}. In the end, we either obtain a consistent matrix or a closer approximation to a consistent one depending on whether the information available allows for making the proposed revisions in a_{ij}.

Because consistency is necessary and sufficient for **A** to have the form $A = (w_i / w_j)$, we use w to explore possible changes in to modify **A** "closer" to that form. We form a consistent matrix $W' = (w'_i / w'_j)$, whose elements are

[8] Harker, P.T., 1987, "Alternative modes of questioning in the analytic hierarchy process," Mathematical Modeling 9, pp. 353-360

approximations to the corresponding elements of **A**. We have $a_{ij} = (W'_i / W'_j)\varepsilon_{ij}$, $\varepsilon_{ij} > 0$. We have the converse of: given a problem with its exact solution, use the properties of this solution to revise the problem, i.e. the judgements which give rise to a_{ij}. Repeat the process to a level of consistency. (see below).

4) Uniform Continuity

Uniform continuity implies that w_i, $i = 1,2,...,n$ as a function of a_{ij} should be relatively sensitive to small changes in the a_{ij} in order that the ratios w_i / w_j remain good approximation to the a_{ij}. For example, it holds in w_i as the ith component of the principal eigenvector because it is an algebraic function of λ_{max} (whose value is shown to lie near n because of 3), and of the a_{ij} and $1 / a_{ij}$ which are bounded.

Let us now turn to more elaboration of the near consistency condition in 3). We first show the interesting result, that inconsistency or violation of (1) by various a_{ij} can be captured by a single number $\lambda_{max} - n$ which measures the deviation for all from w_i / w_j.

Assume that the reciprocal condition $a_{ji} = 1 / a_{ij}$ and boundedness $1 / K \le a_{ji} \le K$ where K > 0 is a constant, hold. Let $a_{ij} = (1 + \delta_{ij}) w_i / w_j$, $\delta_{ij} > -1$, be a perturbation of $W = (w_i / w_j)$ where w is the principal eigenvector of **A**.

Theorem 2.9 $\lambda_{max} \ge n$

Using $a_{ji} = 1 / a_{ij}$, and $Aw = \lambda_{max} w$, we have

$$\lambda_{max} - n = \frac{1}{n} \sum_{1 \le i \le j \le n} \frac{\delta_{ij}^2}{1 + \delta_{ij}} \ge 0$$

Theorem 2.10 *A is consistent, if and only if,* $\lambda_{max} = n$

If **A** is consistent, then because of (1), each row of **A** is a constant multiple of a given row. This implies that the rank of **A** is one, and all but one of its eigenvalues $\lambda_i = 1,2,...,n$ are zero, However, it follows from our earlier argument that

$$\sum_{i=1}^{n} \lambda_i = Trace(A) = n$$. Therefore $\lambda_{max} = n$. Conversely $\lambda_{max} = n$ implies $\varepsilon_{ij} = 0$ and

$a_{ij} = w_i / wj$.

A measure of inconsistency is obtained by taking the ratio of $\lambda_{max} - n$ to its average value over a large number of reciprocal matrices of the same order n, whose entries are randomly chosen in the interval[1/K,K]. If this ratio is small (e.g., 10% or less – for example 5% for 3 by 3 matrices)[9], we accept the estimate of w. Otherwise, we attempt to improve consistency and derive a new w. After each iteration, we assume that the new

[9] Golden, B.L. and Q. Wang, 1989, "An Alternate Measure of Consistency:, in The Analytical Hierarchy process – Applications and Studies, eds, Golden, Wasil and Harker, Springer-Verlag, New York.

matrix is a perturbation of **W** and its eigenvalue and eigenvector are perturbations of n and w, respectively.

In his experimental work in the 1950's. the psychologist George Miller, found that in general, people (such as chess experts looking ahead a few moves to decide on a good next move) could deal with information involving simultaneously only a few facts: seven plus or minus two. With more, they become confused and cannot handle the information. Since the individuals needs to maintain consistency in his decision matrix, he cannot consider more than a few options at a time. This is in harmony with the established fact that for a reciprocal matrix (though not in general) the eigenvalue is stable for small perturbations when n is small.

We have seen that only order preserving derived scale w are of interest. There are so many ways to obtain w from **A**. Most of them are error minimizing procedures such as the methods of least squares:

$$\sum_{i,j=1}^{n}(a_{ij} - \frac{w_i}{w_j})^2$$

which also produces nonunique answers. Only the principal eigenvector satisfies order preserving requirements when there is inconsistency. We summarize with:

Theorem 2.11 *If a positive n by n matrix A is: reciprocal, homogeneous, and near consistent, then the scale w derived from $Aw = \lambda_{max}w$ is order preserving, unique to within a similarity transformation and uniformly continuous in the a_{ij}, $i,j,=1,2,...,n$.*

Similar results can be obtained when **A** is nonnegative. Also we have extended this discrete approximation of **A** by **W** to the continuous case of **A** reciprocal kernal and its eigenfunction[10].

4. Structural properties of Positive Reciprocal Matrices

We make the following observations on the structure of reciprocal matrices. The elementwise product of two n by n reciprocal matrices is a reciprocal matrix. It follows that the set of reciprocal matrices is closed under the operation Hadamard product. The matrix e^Te is the identity: $e^Te=eTe \text{ o } e^Te = ee^T$ and A^T is the inverse of **A**, $AoA^T=A^ToA= e^Te$. Thus the set **G** of n by n reciprocal matrices is an abelian group. Because every subgroup of an abelian group is normal, in particular, the set of n by n consistent matrices is a normal subgroup ($EoWoE^T=W$) or the group of positive reciprocal matrices.

Two matrices **A** and **B** are **R**-equivalent (**A R B**) if, and only if, there are a vector w and positive constant a and b such that $(1/a)Aw=(1/b)Bw$. The set of all consistent matrices can be partitioned into disjoint equivalence classes. Given a consistent matrix **W** and a perturbation matrix **E** such that Ee=ae, a>0 a constant, we use the Hadamard product to define **A'=WoE** such

[10] L. G. Vargas, 1993, "A Model of Neural Inpuslse Firing and Synthesis", Journal of mathematical Psychology 37, pp. 200-219.

that $(1/a)\mathbf{A'W} = (1/n)\ \mathbf{Ww}$. $\mathbf{A'}$ and $\mathbf{W}$ are equivalent. There is a 1-1 correspondence between the set of all consistent matrices and the set of all matrices $\mathbf{A'}$ defined by such Hadamard products. An equivalent class $\mathbf{Q(W)}$ is the set of all $\mathbf{A'}$ such that $\mathbf{A'R\ W}$. The set of equivalence classes $\mathbf{Q(W)}$ forms a partition of the set of reciprocal matrices. It is known that all elements in $\mathbf{Q(W)}$ are connected by perturbations $\mathbf{E, E', E''}, \ldots,$ corresponding to a fixed value of $a > 0$ such that $(\mathbf{E o E' o E''}..)e = ae$. Thus given an arbitrary reciprocal matrix $\mathbf{A}$, there exists an equivalence class to which $\mathbf{A}$ belongs.

DeTurk[11] has proved that: The structure group $\mathbf{G}$ of the set of positive reciprocal $n \times n$ matrices has $2n!$ connected components. It consists of nonnegative matrices which have exactly one nonzero entry in each zero and column. These matrices can be written as $\mathbf{D} \bullet \mathbf{S}$, where $\mathbf{D}$ is a diagonal matrix with positive diagonal entries and $\mathbf{S}$ is a permutation matrix, and the negatives of such matrices. The connected component G_0 of the identity consists of diagonal matrices with positive entries on the diagonal. If $\mathbf{A}$ is a positive diagonal matrix with principal right eigenvector $w = (w_1, w2, \ldots, wn)^T$ and $D_\varepsilon G_o$ is a diagonal matrix with positive diagonal entries $d_1, d_2, \ldots, d_n$ then $I_d(A) = DAD^{-1}$ is a positive reciprocal matrix with principal eigenvector $w' = (d_1 w_1, d_2 w_2, \ldots, d_n w_n)^T$. The principal eigenvalue is the same for both matrices. If $w = (w_1, w_2, \ldots, w_n)^T$ and $v_1 / w_1, v_2 / w_2, \ldots, v_n / w_n$ are two positive column vectors, then conjugation by the diagonal matrix $\mathbf{D}_{vw}$ with entries $v = (v_1, v_2, \ldots, v_n)^T$ on the diagonal maps $\mathbf{A}_w$ onto $\mathbf{A}_v$. The corresponding diagonal matrix $\mathbf{D}_{vw}$ provides the inverse map. Moreover, D_{wv} maps the consistent matrix of $\mathbf{A}_w$ to the consistent matrix of $\mathbf{A}_v$.

5.   The Hilbert Metric

There are many ways to judge when two ratio scales are close. But there is one that is particularly attractive for a number of reasons. The theorem of Perron says that if $\mathbf{A}$ is a positive linear transformation on $\mathbf{R}^m$, then there is an $x_0 > 0$ such that for all $x_0 \geq 0, A^n x$ converges in direction to x_o so that

$$\frac{A^{nx}}{\|A^{nx}\|} \to \frac{x_0}{\|x_o\|}.$$

According to Birkhoff[12,13], this theorem is a special case of the contraction mapping theorem which says that if $\mathbf{A}$ is a contraction on a complete metric space (X,D) mapping $\mathbf{X}$ into $\mathbf{X}$, i.e., for some $k < 1$, $D(A_x, A_y) \leq kD(x,y)$ for all $x, y \ \varepsilon X$, then there exits $x_o \varepsilon X$ such that $A^n x \to x_o$ for all $x \ \varepsilon X$.

Birkhoff observed that there is a metric $\mathbf{D}$ on x which all positive linear transformations acting on the set of rays $\mathbf{X}$ in $\mathbf{R}^m_+$ satisfy the contraction condition because convergence in rays is also convergence in direction. The unique metric $\mathbf{D}$, invented by Hilbert for non-Euclidean

[11] DeTurck, D.M., 1987, "The Approach to Consistency in The Analytical Hierarchy Process," Mathematical Modelling 9/3-5, pp. 345-352.

[12] Birkhoff, G., 1957m "Extension of Jentzsch's Theorem", Trans, Amer. Math. Soc. 85, pp. 219-227.

[13] Kohlberg, E., and John W. Pratt, 1982, "The Contraction Mapping Approach to the perron-Frobenius Theory: Why Hilber;s Metric?," Mathematics of Operations Research 7/2.

geometries specialized R^m_+ that marks a positive (or even a nonnegative) matrix to a contraction that satisfies the theorem, is given by:

$$D(x,y) = \log \frac{\max_i(x_i / y_i)}{\min_i(x_i / y_i)}$$

Where x and y are the ith coordinates of the vectors x and y. It is a metric on rays because $\mathbf{D}(ax,by) = \mathbf{D}(x,y)$ for a,b > 0 and thus it is order preserving. A method that needs to preserve order must converge along rays and thus cannot use an arbitrary metric.

Hilbert's metric is useful in analyzing closeness when ratio scales are involved. For example, in medical diagnosis, priorities can be established for the symptoms of one of several diseases. An arriving patient is questioned and priorities established for his or her symptoms. This vector is then compared with each of the priority vectors of the different diseases to determine the most likely illness for the patient. The question is, what is a reliable way for it? The Hilbert metric is one indicator of closeness. So is the Euclidean metric. My colleague Luis Vargas and I have performed experiments on matrices of judgements whose entries are perturbed in a prescribed range. We found that Hilbert's metric is useful for discrimination among vectors in a neighborhood of a known answer, this case the principal eigenvector of the original matrix. The ratios in the Hilbert metric are more sensitive to small variations than are differences in the Euclidean metric. We found experimentally that both metrics taken with respect to a given vector follow a normal and log normal distribution respectively. These distributions can then be used to construct stands to determine if a given point fall sin a range close to the given vector. Multivariate analysis could be used to compare the results of both metrics as to whether the points falling in admissible ranges also fall in the n-dimensional confidence ellipsoid.

6.   Concluding Remarks

Measurement is quantitative information useful for discriminating among magnitudes and among orders of magnitude. Numerical discrimination is different than cognitive discrimination. Creativity and understanding are linked to our cognitive ability and are not to our ability to make precise measurements. It is rare that extreme precision is needed for any sort of understanding and discrimination. Even in science measurement and precision are subject to interpretation. It is the goal s we pursue that need to be served and we are in control of the importance and meaningfulness of these goals as they serve our well being and survival. Precision in the preparation of drugs is necessary, but there is such flexibility that the same size pill is prescribed for all adults regardless of the size of their bodies. Precision in designing the gears of a clock is mandatory, but the precision in time is one and only one aspect of experience that may have to be traded off with other factors. In fact, time is subjective and what is considered is good in punctuality by some may be regarded as some kind of militancy by others. Strict punctuality is a human normative invention not respected in the biology of cells and in birth and death. The question si whether we can access the world directly and satisfactorily with the very judgement we use to evaluate measurement.

One way to generate measurement on different orders of magnitude is to use the senses to make distinctions and to extend their use to lower and higher magnitudes through instruments like the microscope and the telescope. The size of objects is simple one of a very large number of attributes known to the mind. Not all magnitudes have the capability to be infinite as in size and weight, length and time. Most properties such as the ability to love and the ability to excel do not belong to the sense but directly to the mind. The mind will usually bracket their extension in one or in a few orders of magnitudes. Things of the mind must often be defined in objects. Their extension may be theoretically assumed because it cannot be seen with the eyes, felt with the hands or experienced with the body. In principal if there were no people, there may not exist such properties. In fact, these attributes could determine why we assign significance to properties in the real world.

APPENDIX B

PROJECT EVALUATION AND SELECTION MODELS

PROJECT EVALUATION AND SELECTION[1]
Evaluation and Selection Models: Basic Types

There are basically two types of selection models, numeric (quantitative) and nonnumeric (qualitative). Nonnumeric models are older and simpler and have a few subtypes to examine. Selecting the type of project evaluation depends on the philosophy and wishes of management. The weighted models are favored for three fundamental reasons. First, they allow multiple objectives of all organizations to be reflected in the important decisions about which projects will be supported and rejected. Second, scoring models are easily adapted to change in managerial philosophy or changes in the environment. Third, they do not suffer the bias towards the short run that is inherent in profitability models that discount future cash flows.

The structure of weighted scoring models is quite straightforward. Its virtues are may. Nevertheless, the actual use of scoring models is not as easy as it might seem. Decision-makers are forced to make difficult choices and they are not always comfortable doing so. They are forced to reduce often vague feelings to quite specific words or numbers. Multicriteria and multiperson decision making is not simple.

The types of models discussed in this appendix includes:

NONNUMERIC MODELS
- Sacred Cow
- Operating Necessity
- Competitive Necessity
- Product Line Extension
- Comparative Benefit Model

NUMERIC MODELS: PROFITABILITY
- Payback Period
- Average Rate of Return
- Discounted Cash Flow
- Internal Rate of Return Profitability Index
- Other Profitability Models

NUMERIC MODELS: SCORING
- Unweighted 0-1 Factor Scoring
- Unweighted Factor Scoring
- Weighted Factor Scoring
- Constrained Weighted Factor Scoring

OTHER MODELS: OPERATIONS RESEARCH & ECONOMICS (Mentioned in the main report)
- Cost Benefit Analysis
- Operations Research Models
- Weighted Explicit Linear Models
- Equally weighted Explicit Linear Models

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[1] J. Meredith, S. Mantel, Jr. "Project Management: A Managerial Approach, 3rd Edition, John Wiley & Sons, Inc. pp. 47-79.

NONNUMERIC MODELS – Although it is easy to dismiss the nonnumeric models as unscientific, they should not be discounted casually. These models are clearly goal-oriented and directly reflect the concerns of the organization.

- SACRED COW - The project is suggested by a senior and power official in the organization. Often the project is initiated by a simple comment such as, "If you have the chance, why don't you look into ...," and there follows and undeveloped idea for a new project, for the development of a new market, for the installation of a new information system, and for some other project requiring an investment of the organization's resources. The immediate result of this bland statement is the creation of a "project" to investigate whatever the boss has suggested. The project is "sacred" in the sense that it will be maintained until the successfully concluded, or until the boss, personally, recognizes the idea as a failure and terminates it.

- OPERATING NECESSITY – If a flood is threatening the plant, a project to build a protective dike does not require much formal evaluation. If a project is required in order to keep a system operating, the primary question becomes: Is the system worth saving at the estimated cost of the project? If the answer is yes, the project costs will be examined to make sure that they are kept as low as is consistent with project success, but the project will be funded.

- COMPETITIVE NECESSITY - The decision to undertake a project is based on the desire to maintain competitive position in the market place. Investments in operating necessity takes precedence over competitive necessity., both types of projects may bypass the more careful numeric analysis used for projects deemed to be less urgent or less important to the survival of the organization.

- PRODUCT LINE EXTENSION – A product to develop and distribute new products would be judged on the degree to which it fits the firm's existing product line, fills a gap, strengthens a weak link, or extends a line in a new, desirable direction. Sometimes careful calculations of profitability are not required. Decision-makers can act on their beliefs about what will be the likely impact on the total system performance if the new product is added to the line.

- COMPARATIVE BENEFIT MODEL – Assume that an organization has many projects to consider. Senior management would like to select a subset of the projects that would be most benefit to the firm, but the project do not seem to be easily comparable. The concept of comparative benefits, if not a formal model, is widely used for selection decision on all sorts of projects. The projects are evaluated according to the evaluator's recommendations.

  Of the several techniques for ordering projects, the Q-Sort[2]. Firs, the projects are divided into three groups – good, fair, and poor according to their relative merits. If

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[2] Henlin, A. F., and W. E. Souder, "Experimental Test of a Q-Sort Procedure for prioritizing R&D Projects", IEEE Transactions on Engineering Management, NOV 1974.

any group has more than eight members, it is subdivided into two categories, such as fair-plus, and fair-minus. When all the categories have eight or less members, projects within each category are ordered again from best to worst. Again, the order is determined on the basis of relative merit. The rater may use specific criteria to rank each project or may simply use general overall judgement.

The evaluation process may be carried out by one person who is responsible for evaluation and selection or by a committee. In a committee evaluation, it is common for such ranking to differ from rater to rater, but they do not often vary strikingly because the raters rarely differ widely on what they feel to be appropriate for the parent organization.

NUMERIC MODELS: PROFITABILITY – Majority of organizations using project evaluation and selection models use profit/profitability as the sole source of measure of acceptability

- PAYBACK PERIOD – The payback period for a project is the initial fixed investment in the project divided by the estimated annual cash inflows from the project. The ratio of these quantities is the number of years required for the project to repay its initial fixed investment. This method assumes that the cash inflows will persist at least long enough to pay back the investment, ignores any cash inflows beyond the payback period. The method also serves as an inadequate proxy for risk. The faster the investment is recovered, the less the risk to which the organization is exposed.

- AVERAGE RATE OF RETURN – Often mistaken as the reciprocal of the payback period, the average rate of return is the ratio of the average annual profit (either before or after taxes) to the initial or average investment in the project. Because the average annual profits are not equivalent to net cash inflows, the average rate of return does not equal the reciprocal of the payback period.

- DISCOUNTED CASH FLOW – Also referred to as the present value method, the discounted cash flow method determines the net present value of all cash flows by discounting them by the required rate of return (also know as the hurdle rate, cutoff, rate, and similar terms) as follows,

$$NPV(project) = A_0 + \sum_{t=1}^{n} \frac{F_t}{(1+k)^t}$$

Where

F_t = the net cash flow in the period t,

k = the required rate of return, and

A_0 = initial cash investment

To include the impact of inflation (or deflation) where p_t is the predicted rate of inflation during the period t, we have

$$\text{NPV(project)} = A_0 + \sum_{t=1}^{n} \frac{F_t}{(1+k+p_t)^t}$$

- INTERNAL RATE OF RETURN – If we have a set of expected cash inflows and cash outflows, the internal rate of return is the discount rate that equates to the present value of the two set of flows. If A_t is an expected cash outflow in the period t and R_t is the expected inflow for the period t, the internal rate of return is the value k that satisfies the following equation.

$$A_0 + \frac{A_1}{(1+k)} + \frac{A_2}{(1+k)^2} + ... + \frac{A_n}{(1+k)^n} = \frac{R_1}{(1+k)} + \frac{R_2}{(1+k)^2} + ... + \frac{R_n}{(1+k)^n}$$

where $t = 1,2,3,...n$

- PROFITABILITY INDEX – Also known as the benefit-cost ratio, the profitability index is the net present value of all future expected cash flows divided by the initial cash investment.

- OTHER PROFITABILITY MODELS – There are a great man variations of other profitability models. These variations fall into three general categories:

  (1) those that subdivide net cash flow into the elements that comprise the net flow,
  (2) those that include specific terms to introduce risk (or uncertainty, which is treated as risk) into the evaluation,
  (3) those that extend the analysis to consider effects that the project might have on other projects or activities in the organization

- Comments on profit-profitability numeric models include:

ADVANTAGES
1. The undiscounted models are simple to use and understand.
2. All use readily available accounting data to determine cash flows.
3. Model output is in terms familiar to decision makers.
4. With a few exceptions, model output is on an "absolute" profit/profitability scale and allows "absolute" go/no-go decisions.
5. Some profit models account for project risk.

DISADVANTAGES

1. These models ignore all nonmonetary factors except risk.
2. Models that do not include discounting ignore the timing of the cash flows and the time value of money.
3. Models that reduce cash flows to their present value are strongly biased towards the short run.
4. Payback-type models ignore cash flows beyond the payback period.
5. The Internal Rate of Return model can result in multiple solutions.
6. All are sensitive to errors in the input data for the early years of the project.
7. All discounting models are nonlinear, and the effects of changes (or errors) in the variable parameters are generally not obvious to most decision makers.
8. Those models incorporating the risk of research and development and/or process (the commercial success risk factor is excluded from this comment) mislead the decision maker. It is not so much that the research-development-process success is risky as it is that the time and cost required to ensure project success is uncertain. The application of these risk terms applies mainly to R & D projects.
9. Some models are oriented only towards evaluation of projects that result in new projects.
10. All these models depend for input on a determination of cash flows, but it is not clear how the concept of cash flow is properly defined for the purpose of evaluating projects.

NUMERIC MODELS: SCORING

- UNWEIGHTED 0-1 FACTOR– A set of relevant factors is selected by management. These are usually listed in preprinted form, and one or more raters score the project on each factor depending on whether or to it qualifies for that individual criterion. The raters are chosen by senior management for the most part from the rolls of senior management. The criteria for choice are a clear understanding of the organizational goals and a good knowledge of the firm's project portfolio.

     The main advantage of such a model is that it uses several criteria in the decision process. The major disadvantages are that it assumes all criteria are of equal importance and allows for no gradation of the degree to which a specific project meets the various criteria.

- UNWEIGHTED FACTOR - The second disadvantage of the 0-1 factor model can be dealt with by constructing a simple linear measure of the degree to which the project being evaluated meets each of the criteria contained on the list. For example, using the criteria "estimated profits in dollars", a sample unweighted factor scoring scale may be constructed.

SCORE	PERFORMANCE LEVEL
5	Above $1,000,000.00
4	$750,000.00 to $999,999.99
3	$500,000.00 to $749,999.99
2	$200,000.00 to $499,999.99
1	Less than $200,000.00

Table 1 Sample Scoring using the Unweighted Factor scoring Model

- WEIGHTED FACTOR SCORING MODEL – When numeric weights reflecting the relative importance of each individual factor are added, we have a weighted factor scoring model. In general, it takes the form

$$S_i = \sum_{j=1}^{n} s_{ij} w_j \quad j = 1,2,3...,n$$

where

S_i = the total score of the ith project

s_{ij} = the score of the ith project on the jth criterion, and

w_j = the weight of the jth criterion

The weights, w_j, may be generated by any technique that is acceptable to the organization's policy makers. The weight of each criterion can be interpreted as the "percentage of the weight according to that particular criterion."

A special caveat is in order. It is quite possible with this type of model to include a large number of criteria. It is not particularly difficult to develop scoring scales and weights, and the ease of gathering and processing the required information makes it tempting to include marginally relevant criteria along with the obviously important item. Resist this temptation! After the important factors have been weighted, there usually is little residual weight to be distributed among the remaining elements. The result is that the evaluation is simply insensitive to major differences in the score on trivial criteria. A good rule of thumb is to discard elements with weights less than 0.02 or 0.03. (As with any linear model, the users should be aware that the elements in the model are assumed to be independent. This presents no particular problem for the scoring models because they are used to make estimates in "steady state' systems, and are not concerned with transitions between states.

- CONSTRAINED WEIGHTED FACTOR SCORING MODEL – The temptation to include marginal criteria can be partially overcome by allowing additional criteria to enter the model as constraints rather than weighted factors. These constraints represent project characteristics that must be present or absent in order for the project to be acceptable. We would amend the weighted scoring model to take the form:

$$S_i = \sum_{j-1}^{n} s_{ij} w_j \prod_{k=1}^{v} c_{ik}$$

where $c_{ij}=1$ if the ith project satisfies the kth of v constraints, and 0 if it does not.

Again, a caveat is in order. Exercise care when adopting constraints. It may seem obvious that we should not consider any project if it has no reasonable assurance of long-run profitability. But such a constraint force us to overlook a project that, although unprofitable itself, might have a strong, positive impact on the profitability of other projects in which we are interested.

OTHER MODELS: FROM OPERATIONS RESEARCH AND ECONOMICS

- Cost Benefit Analysis

- Operations Research Models

- Explicit Linear Models

  - Weighted

  - Equally weighted

APPENDIX C

NUMERIC SCALES

NUMERIC SCALES

The misuse of numbers is one reason that numerical analyses are sometimes flawed. Unfortunately, some decision models based on flawed numerical reasoning may go undetected, leaving the decision makers left wondering why the results do not make sense. Therefore, a brief review of what is know as the levels of measurement using Stevens' classification scheme[1],[2],[3] are discussed in detail.

1. Nominal – Nominal numbers, the lowest level in terms of meaning conveyed, are just numerical representation for names. Nominal numbers are used for identification purposes only and imply nothing about ordering. Telephone numbers and social security numbers are ordinal. Are you 'older' or 'better' than someone else because your telephone number is higher? Obviously not, and people rarely make mistakes with nominal numbers.

2. Ordinal – Ordinal number implies an order or ranking among elements. The order may be either increasing or decreasing depending on application. A ranking implies an ordering among elements but nothing more. It does not imply anything about the differences or interval between items. For example, if we know only that a professional baseball team finished in second place at the end of the season, we do not know if the team was one game behind the first place team or twenty games behind. Care must be taken to not add or multiply ordinal number. Errors arising from the addition of ordinal data are too common.

3. Interval – Interval scale data possess the meaning of Nominal and Ordinal data, as well as having meaning about the interval between objects. Corresponding intervals on different parts of an interval scale have the same meaning. If we have interval level data then we can infer that the interval between two objects with values of 20 and 5 (an interval of 15) is equivalent to the interval between two objects with values of 80 and 65. Interval level data can be use din arithmetic operations such as addition and multiplication. However, after adding interval level data, one can not infer that a total of 100 is twice as good as a total of 50. If one were to allocate resources based on this inference, then the allocation would be incorrect.

4. Ratio – Ratio level data (sometimes called ratio scale) is the highest level, having Nominal, Ordinal, and Interval properties, as well as the property of ratios. Corresponding ratios on different parts of a ratio scale have the same meaning. If we have a ratio scale data, then the ratios between two objects with values of 100 and 50 is equivalent to the ratios of two objects with values of 6 and 3. A ratio scale is often defined as one having a true zero point. For our purposes, it is easier to think of a ratio

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[1] S. S. Stevens, "On the Theory of Scales of measurement", Science (103, 1946), pp. 677-680.

[2] F. S. Roberts, Measurement Theory with Applications to decision-making, Utility and the Social Science, (London, Addison Wesley, 1979).

[3] J. C. Vansnick, "Measurement Theory and Decision Aid", Proceedings of the Third International Summer School on Multiple Criteria Decision Methods, Applications and Software, (Monte Estoril, Portugal: July 1988).

scale as one for which equivalent ratios are considered equal. Temperature on the Fahrenheit scale is not a ratio measure. However, temperatures on the Kelvin scale, which has ratio property, such inferences would be correct.

For mathematical operations, the nominal, ordinal, interval, and ratio scales have additional meaning:

- Addition/subtraction and multiplication/division require at least interval level meaning

- An interval level number can be multiplied by a constant or a ratio level number but cannot be multiplied by another interval level number

- There are no restriction when using ratio level numbers

APPENDIX D

EVALUATION OF GROUP DECISION MAKING

METHODS

dissertation excerpt from Kirti Peniwati Srisoepardani, Ph.D.

Chapter 6

Evaluation of Group Decision Making Methods

6.1 Introduction

In this chapter we are concerned with the evaluation of different methods of group decision-making on a wide set of criteria which range from the strictly technical, to the psychophysical and social, and finally, to the logical and scientifically valid. Our purpose is to identify similarities and differences with the aim of showing from such wide consideration which method is more reliable, and is likely to gain greater attention both in academia and in practice. This writer is not an inexperienced (and completely unbiased) observer as I have familiarized myself with, have applied several of these methods, and have developed opinions and preference about them. It will be seen below that the AHP is the most comprehensive of these methods in structure, in analysis, in mathematical validity, and in its producing truthful results. Its outcome would survive outside influences because it is able to incorporate such influences in its hierarchies, and assess their relative impact on the outcome in a way that does not tax one's intelligence to accept its procedures, nor do these procedures alienate the user. The Analytic Network Process (ANP) is a natural generalization and extension of the AHP that allows feedback and dependence among decision elements and clusters of elements [Saaty, 1996]. The fact that numerous examples of applications of the ANP exist shows that the AHP can be generalized, and is thus a validation of the AHP itself, as generalizability is a necessary condition for a good decision theory.

There are criteria proposed in the literature to judge group decision making. We use these criteria as a basis to establish new criteria for judging group decision support methods. We identify and briefly describe most of the known methods in decision-making. We define various intensity measures on each of the new criteria. We evaluate each of these methods by assigning it the intensity that describes it best on each criterion, explaining briefly why that intensity is appropriate for the method. In this manner, the methods are compared and contrasted with respect to each criterion, and an AHP model is developed to obtain an overall rating of the methods.

6.2 Criteria for Group Decision Making Methods

Rubin [Swap and associates, 1984] proposed six quality indicators for group decision making that address both achievement and maintenance goals [Brightman; 1980, 1988]: *efficiency, careful development and analysis of alternatives, fairness, member satisfaction and morale, leadership effectiveness,* and *growth over time*. These indicators are developed from a group process point of view, and need to be translated into another set of indicators before they can be used as criteria for evaluating the methodologies that facilitate for a group to excell on those quality indicators. We exclude efficiency from our analysis because it is highly dependent on the way the group is organized and lead. However, we will later outline how the AHP facilitates efficient group decision making without making an attempt to compare or contrast it with the other methods. We perceive *growth over time* as *learning*. We assume that a method which addresses group maintenance (leadership effectiveness and learning) will also ensure member satisfaction and morale, hence we do not consider the latter as a criterion explicitly.

First of all, a general method for group decision making must provide a facilitator with the means to lead the group toward its achievement and maintenance goals. The method must also assist the facilitator in enhancing individual and group learning, both single loop or small "l" learning and double loop or big "L" learning [Argyris, 1977, 1994; Pascale, 1991]. It addresses the first if it

enables the group to solve problems of implementing organizational policies and achieving the goals of the organization through incrementally, based on past performance and knowledge. It addresses the second if it facilitates questioning the underlying assumptions of those policies and goals through breakthrough shift of knowledge. Careful development of alternatives means that the group must not view a problem from a scope too narrow to ensure a meaningful solution or too broad to ensure controllable actions. It also means that the group must be able to identify a set of distinct alternatives from a level of abstraction that is adequate for the group. For example, a group of top executives would view a problem from a higher level of abstraction than would a group of operational managers because they have a much wider choice space from which to draw controllable alternative courses of actions. Careful analysis of alternatives requires the group to work with a model/structure [Reagan-Cirincione, 1994] with the appropriate breadth (for relevance) and depth (for precision). A successful analysis depends on faithfulness of judgment elicitation, psychophysical applicability, and the depth of the analysis. One must first accept the premise that eliciting judgment by comparing two objects with respect to a certain property would produce the most faithful representation of one's tacit preference relations. Faithful judgment can be obtained if: (1) it is expressed directly by the decision maker, rather than derived from some other form of judgments, (2) it is not clear to the decision maker as to how that particular judgment would ultimately affect the outcome and hence would not play games with it to influence the outcome, thus preventing *strategic judgment* [Dummett, 1984], and (3) the decision maker has the choice to express preference relations numerically (as a minimum for representing objective measurement) or verbally (for representing perception or feeling), or even graphically. Depth of analysis means how well an analytical method provides the means to guide decision makers' thinking to ensure the validity of the outcome. It includes, for example, having a feedback mechanism for making changes and adjustments or directing the decision-maker to an expert or looking for specific information.

Fairness is addressed both during group interaction, and when the diverse information or judgments from individuals must be mathematically aggregated into one judgment for the group. On this criterion, we are only concerned with the method of aggregation, since group discussion would be controlled by the facilitator. A strong condition for a successful decision theory is that it needs to result in the alternatives being cardinally separated rather than simply ordered. The group members themselves may need to be prioritized as to the reliability of their opinions. Other actors or stakeholders who may be affected by the implementation of the decision often need to be considered, and a successful method needs to have a way to include their judgments.

Most significantly, a method must be applicable, valid, and reflect the truth. One would be concerned with such issues as: (1) is the method applicable to conflict resolution, (2) does it apply to intangibles in the same way it does to tangibles, (3) does it have mathematical validity and generality, and is it supported with axioms and theorems, (4) can the method be applied to psychophysical measurement, and (5) is the outcome valid, ensuring, for example, reliability in prediction.

Applicability to conflict resolution means the method must provide a way for each conflicting party to evaluate the costs and the benefits of giving up some of what it has, in return for getting what it wants from the other party. Applicability to intangibles involves inclusion, and measurement of, the multidimensionality of the factors involved. Mathematical validity and generality calls for formal mathematical representation of the logic and reasoning behind a theory and the economy of additional assumptions required for its generalization. Psychophysical applicability means that an analytical method must deal with the measurement of relationships between the physical attributes of stimuli and the resulting sensation reflecting diminishing response to increasing stimulus such as, for example, that described by the Weber-Fechner law. Validity of the outcome involves the accuracy of the outcome in predicting situations. One should be careful, however, to define what constitutes a prediction situation. In an experimental study, Schoemaker and Waid [1982] showed that guesswork direct estimation of the rank of multicriteria objects produces a very different ordinal ranking from that of the AHP.

The following criteria are used to compare and contrast the various methods:

1. Group maintenance: leadership effectiveness.

We assume that all group methods enhance leadership effectiveness. We use a democratic leader's characteristics as criteria for leadership effectiveness, assuming that the group mostly works in moderate situational control in terms of leader-member relations, task clarification, and position power [Lewin, Lippit, and White, 1939; Fiedler, 1973]. A method is rated *low* if it is highly technical or does not involve much interaction and where leadership is of a little concern, *medium* if it provides no more than structure to facilitate group leadership, and *high* if it also provides other collaborative tools and the necessary control mechanism to guide the facilitator's leadership actions in pursuing the group's achievement and maintenance goals.

2. Group maintenance: learning

It is assumed that objective knowledge, widely accepted and agreed upon knowledge, is considered less important by the people involved in the group than what they know from their experience relevant to the issues and what they learn by problem solving within the group. A method is rated *low* if it advances technical learning that has little to do with the group member's subjective values, *medium* if it improves understanding with regard to cause-effect relations in a problem (but actions may not be clear, single loop or small 'l' learning only, or, it does not provide clear evaluation of alternatives), *high* if it facilitates both single and double loop learning, or small "l" and big "L" learning (leading to action), and *very high* if it also enables one to produce the necessary material to facilitate learning beyond the membership of the group.

3. Problem abstraction: scope

The need for problem abstraction or definition is inherent in any decision making, therefore this indicator is assumed to be addressed by all methods. The question is whether a method explicitly addresses this issue or not. Voting is an exception for which alternatives are always given, hence problem abstraction is not applicable and this method is rated *NA*. A method is rated *low* if it does not propose a specific technique and does not involve problem analysis that enhances the scope of abstraction, *medium* if its technique creates boundaries that limit group thinking, or, if it does not propose a specific technique but involves problem analysis that serves as feedback to broaden problem abstraction, and *high* if double loop learning is explicitly addressed.

4. Problem abstraction: development of alternatives.

It is generally assumed that the alternatives are not given to the group, hence any method involving problem structuring must go through a process of identifying alternatives. It is assumed that multicriteria methods require a process of generating alternatives that allows a certain degree of interaction among group members. It is also assumed that a method for enhancing problem abstraction leads to a set of alternatives. Again, voting is an exception because a set of alternatives is always given. A method is rated *NA* if the alternatives must be given, *low* if it does not provide a specific technique for identifying alternatives, *medium* if it ensures a free wheeling environment without group interaction, or, if it generates incremental alternatives (it is assumed that innovative change is more preferred to incremental change), *high* if it ensures a free wheeling environment as well as group interaction but no requirement that the alternatives selected satisfy certain properties or requirements (e.g., distinct or independent), *very high* if it is also based on challenged assumptions, if it systematically generates alternatives, or, if it requires the alternatives to satisfy certain properties to ensure the validity of the outcome.

5. Structure: breadth

A structure is said to be broad if it has many distinct elements (criteria) that are assumed to be independent of each other. A problem that is modelled by more than one such structure is considered to be even broader. A method is ranked *NA* (not applicable) if it does not involve problem structuring, *low* if the method allows only one element (direct comparison), *medium* if the method creates a constraint with respect to the number of elements, and *high* if there is no such constraint.

6. Structure: depth

A structure is said to be deep if each element is broken down into sub-elements, each sub-element into sub-sub-elements and so on down to the most detailed elements. A method is ranked *NA* if it does not involve structuring, *low* if it allows only one element, *medium* if it creates a constraint with respect to the number of elements, and *high* if there is no such constraint.

7. Analysis: faithfulness of judgments

A method is rated *NA* if it does not involve problem analysis, *low* if it does not include intensity of preferences, *medium* if it involves direct assignment of numbers to represent intensity on an unvalidated scale, *high* if it is derived from some other judgments carefully elicited, *very high* if it is elicited in the most elementary way (pairwise comparison with respect to a property), expressed in a way that fits the decision maker best (numerically, verbally, or graphically), or, if it is by design an objective method, or, if it is continuously improved.

8. Analysis: breadth and depth of analysis (what if)

A method is rated *NA* if it does not involve problem analysis, *low* if it allows judgment, but not analysis, *medium* if the depth of analysis is constrained by the method's structure, *high* if it provides the means for careful thinking (but it is difficult to review previous analysis), and *very high* if it facilitates careful thinking and review.

9. Fairness: cardinal separation of alternatives

This indicator is applicable only to methods that involve aggregation of judgments of individual members. Alternatives can only be treated either fairly (*high*) or not fairly (*low*). A method is evaluated according to its consistency with the impossibility problem intrinsic in ordinal group aggregation. An aggregation method is rated *low* if it uses an ordinal scale of measurement and *high* if it uses an interval or a ratio scale. A method is rated *NA* if it does not involve judgment aggregation.

10. Fairness: prioritizing of group members

This indicator is also applicable only to methods that involve aggregation of individual judgments. Voting theories usually operationalize fairness as equal treatment of the voters. In group decision

making, there may be circumstances in which the group may want to apply the concept of fairness with unequal treatment of the individuals involved. For example, weights may need to be assigned to the members according to the relevance of their expertise or to their known previous contribution to the goal. A method is rated *NA* if it does not involve judgment aggregation, *low* if individual preferences are represented on an ordinal scale, *medium* if the preferences are represented on an interval or ratio scale (but the individuals must carry the same weight), *high* if it also provides a group with an option to treat group members unequally (but the weights are assigned arbitrarily), and *very high* if it provides a method to determine the weights as appropriately as the group wishes.

11. Fairness: consideration of other actors and stakeholders

This criterion is applicable only to methods that involve problem analysis. A method is rated *NA* if it does not involve problem analysis, *low* if addressing fairness to other actors which might be possible (but it is not yet made explicit in the method), *medium* if it addresses the issue explicitly but qualitatively, and *high* if it addresses the issue both explicitly and quantitatively.

12. Scientific and mathematical generality

A method is rated *NA* if it does not involve problem analysis, *low* if it does not involve any mathematics, *medium* if it involves mathematics that is not axiomatized, or, it involves multidimensional concepts that may be axiomatized differently by different researchers leading to a diversity of theorems, *high* if it is axiomatized with more or less unified conceptualization (but its generalization has considerable mathematical rigor), and *very high* if its theorems are axiomatized and generalizable in a natural and less taxing way by not requiring many new assumptions.

13. Applicability to tangibles

A method is rated *NA* if it does not involve problem analysis, *low* if it does not involve quantification of intangibles, or, simply assigns arbitrary ordinal numbers to intangibles, *medium* if it involves measuring intangibles on an interval or a ratio scale (but must be represented by tangibles or intensities in absolute terms with no assigned priority, *high* if it involves measuring intangibles on an interval or a ratio scale, but must be represented by tangibles or intensities in absolute terms with assigned priority), and *very high* if its measurement is applicable to intangibles and gives an assessment of their relative importance, both absolutely or relatively, as the user wishes.

14. Psychophysical applicability

A method is rated *NA* if it does not involve problem analysis, *low* if it does not address the Weber-Fechner law, *medium* if it could but requires a complex model that may not be practical to develop or to apply, and *high* if it is psychophysically applicable.

15. Applicability to conflict resolution

A method must have a theory and perhaps also normative standards for best solution of a group conflict that is understandable, acceptable, practical, flexible, and has been demonstrated to work well in practice. Such a method would be rated *high*. However, secrecy makes it hard to use such an approach in a clear step by step fashion, and hence people often resort to less structured and less

explicit methods. For this reason, an analytical method for dealing with conflict resolution is rated *medium*.

16. Validity of the outcome (prediction)

A method is rated *NA* if it does not involve problem analysis, *low* if it uses ordinal measurement with no structural representation of a problem, *medium* if it uses cardinal measurement, but its main concern is computation, or, if it uses ordinal measurement with some problem representation, or, if it provides a rigorous model without measurement, *high* if it uses cardinal measurement, but mathematical validity sets limits on the structural representation of a problem, and *very high* if it uses cardinal measurement and no theoretical limit with respect to the structural representation of the problem.

6.3 Group Decision Making Methods

The methods, other than the AHP described in earlier chapters, are outlined to highlight the points of interest for our evaluation. Couger [1995] provides a summary of most of the methods.

6.3.1 Structuring

Analogy and *attribute association* are methods for gaining fresh prespectives on a problem to create an alternative space from which meaningful and controllable distinct alternatives are likely to be identified. They involve the use of key words from the original formulation of a problem as the means to identify relations between the otherwise unrelated analogy/association and the original problem.

Boundary examination is a conscious effort to openly challenge and restructure the underlying assumptions that prevent one from seeing a problem from a broad perspective. The *progressive abstraction method* increases problem abstraction implied in the goal step by step. This, along with the first, differ in technique but their purpose is so similar that we do not consider them as different methods.

Brainstorming [Osborne, 1957] is based on the premise that deferred judgments enhance creativity and that oral communication diminishes it. Its modification includes, e.g., brainwriting (generating ideas in writing), bug list and negative brainstorming (generating complaints to identify weaknesses), the Crawford blue slip method (independently brainstorms in response to a number of questions that are related to a problem), and discussion among group participants as long as it is not judgmental.

Morphological connection is an attempt to broaden the space of alternatives not through problem abstraction, but from different combinations of problem attributes as in a hierarchy. Despite what the term may imply, this method is not designed for connecting or structuring different ideas related to a problem to make a decision.

Why-What's Stopping is proposed for formulating ill-structured problems [Basadur, Ellspermann, and Evans; 1994]. It consists of a series of diverging and converging ideas by seeking responses to the questions: "How might we..." (to elicit ideas on alternative solutions) "What's stopping us ..." (to provide narrower subproblems for each response to the "How might we..." query), and "Why would we need to ..." (to ensure that we work on the right problem as stated in the "How might we..." query). The outcome of this process is a big picture of a problem, indicating relationships among problems and sub-problems, to help decision makers select the most meaningful problem area to work on.

6.3.2 Ordering and Ranking

Voting, as has been discussed at length in the previous chapters, elicits ordinal judgments and mathematically aggregates them into a group judgment. It is considered as a single criterion analysis since the individuals compare alternatives directly. For our purpose, interaction among members is considered irrelevant.

The Nominal Group Technique (NGT) [Delbecq, Van de Ven, and Gustafson; 1975] takes advantage of the positive aspects of brainstorming and brainwriting and structured communication that improves alignment of group members' perception of the problem without working towards concensus.

The Delphi method [Turoff, 1970; Linstone and Turoff, 1975; Gustafson, Shukla, Delbecq, and Walster, 1973] is similar to NGT except that the group members do not meet face to face. A great deal of preparation is required due to the nature of written communication.

Disjointed incrementalism is a method to select the best policy based on its incremental consequences. This method was proposed to deal with complex policy decisions, typically in the government, in which a holistic approach for policy decisions is either impossible or impractical. It has been argued that muddling through is a science.

Matrix evaluations refer to methods for presenting information to facilitate the evaluation of alternatives. It may describe factors and subfactors involved in a problem with their ranking scores, or by providing the relative overall positions of alternatives in a multidimensional space. For example, various company products may be evaluated with respect to their market share and growth (BCG matrix) or various organizational improvement with respect to their importance and imminence [Camillus and Datta, 1991]. These methods, however, do not provide a methodological way to arrive at a decision.

Goal programming is an approach to optimize a set of objective functions subject to constraints. However, it does not necessarily suggest decisions that optimize the objective functions [Ching and Ming; 1987]. It only yields decisions that "satisfice" [Simon, 1957]. The outcome is perceived as indicating trade offs that need to be made in terms of reducing a certain objective in return for an increase in some other objectives.

Conjoint measurement is concerned with predicting the values of a dependent variable by combining a set of independent variables in some functional form. The coefficients of the function are usually estimated by regression techniques. A conjoint analysis measure has been suggested for use as a numerical basis for estimating the priorities of a goal programming problem [O'Leary and O'Leary, 1985].

The concept of *outranking* was developed by B. Roy based on Multiattribute Utility Theory (MAUT) principles with the motivation to improve efficiency without affecting the outcome while considering less information. The idea is to see whether there are enough arguments to decide that an alternative A_i is at least as good as A_j, while there is no *essential reason* to refute that statement. Researchers in this area have worked toward the satisfactory axiomatization of the concept, in which criterion prioritization has been their major preoccupation [Roy and Bouyssau, 1985; Vincke, 1989]. In the meantime, ten different methods have been developed to apply the concept. They differ in how the reason is formalized that leads to refuting the statement that A_i is at least as good as A_j, the type of decision problem (choice, scoring, or ranking) they address, the preference model they adopt (whether or not Weber-Fechner's psychophysical law is to be embraced), whether or not the concept of probability is used, and the way criteria weights are determined. A main weakness of the method is the ordinal way used to combine concordance and discordance that leaves one in doubt about the accuracy of its outcome.

6.3.3 Structuring and Measuring

Bayesian analysis is a popular statistical decision making process which provides a paradigm for updating information in the form of probabilities. It is based on the premise that decisions involving uncertainty can only be made with the aid of information about the uncertain environment in which the decision is made. Bayesian theory updates information by using Bayes theorem, a statement in conditional probabilities relating causes (states of nature) to outcomes. Outcomes are results of experiments used to uncover the causes. Bayesian theory revises initial or prior probabilities of causes, known from a large sample of a population, into posterior probabilities by using the outcome of an experiment or test with a certain probability of success. Prior probabilities are obtained either subjectively or empirically by sampling the frequency of occurence of a cause in a population. Posterior probabilities are those based on the prior probabilities and on both the outcome of the experiment and on the observed reliability of that experiment. Bayesian analysis often makes heavy use of probability trees and that is why we have included in this section.

Multiattribute Utility (Value) Theory (MAUT/MAVT) [Luce and Raiffa, 1957] attempts to maximize a decision maker's utility (under uncertainty) or value (preference) which is represented by a function that maps an object measured on an absolute scale into the decision maker's utility or value relations. The function is constructed by, for example in the case of MAUT, asking lottery questions involving probability to articulate decision makers' value trade-offs among the conflicting attributes. Preferences are used in MAVT. The functional representation of a multicriteria problem is obtained by aggregating the different single attribute functions, each representing a different attribute, by taking into consideration the relative weights of the attributes. The use of objective measurement leads to a complex functional representation if the Weber-Fechner law is to be embraced. The law suggests that the relation between a stimulus and an individual's response is not as smooth as may be indicated by a continuous utility function. Maintaining that "it is now firmly established that expected utility (EU) theory and subjective expected utility (SEU) theory are descriptively invalid," Miyamoto [1992] proposes a *generic utility theory*, designed as a general framework for descriptive multiattribute utility modelling. A group utility or value function that takes the diversified evaluations of its individual members into consideration, can be obtained either by aggregating individual functions or by partial identification of the group function [Seo, 1985]. *Game theory*, which is based on utility theory, has been used to study conflict resolution. Recent versions of *MAUT/MAVT* have tended to look at the broad complexity of a problem within a structured framework and not simply as criteria and alternatives.

6.4 Evaluation of the Methods on the Criteria

1. Group maintenance: leadership effectiveness

Analogy/association, brainstorming, morphological connection, voting, goal programming, and *conjoint analysis* are rated *low* because the methods are highly technical. *Boundary examination, why-what's stopping, NGT, Delphi, disjointed incrementalism, matrix evaluation, outranking, Bayesian analysis,* and *MAUT/MAVT* are rated *medium* because they provide nothing more than simple structures to assist a facilitator. *AHP* is rated *high* because it provides collaborative tools to enhance communication effectiveness, inconsistency and incompatibility measures that provide feedback to the group members to ensure validity of the outcome, structure to facilitate task division, and the means to balance consensus and voting to obtain group judgments.

2. Group maintenance: learning

Brainstorming, voting, goal programming, and *conjoint analysis* are rated *low* because they involve highly technical knowledge. *Brainstorming* excludes member interaction because of its requirement that there be no discussion or criticism of ideas proposed. *Analogy/association, boundary examination, morphological connection, why-what's stopping, NGT, Delphi,* and *matrix evaluation* are rated *medium* because they improve understanding of the problem, but actions to take from them may not be readily clear. *Disjointed incrementalism, outranking, Bayes analysis, MAUT/MAVT* are rated *high* because it is assumed that their outcomes provide learning that leads to action. Research indicates, however, that despite group satisfaction, study participants rated the combination of *NGT* and *MAUT* as *low* in improving knowledge about the content of the issue [Thomas, McDaniel, and Dooris; 1989]. *AHP* is rated *very high* because it provides a highly summarized description of the problem that facilitates learning beyond membership of the group. Participants in an experimental study ranked the AHP as the least difficult and the most trustworthy method among those studied [Schoemaker and Waid, 1982]. It is assumed that the easier to apply and the more trustworthy a method is, the more one learns from its application.

3. Problem Abstraction: Scope

Voting is rated *NA* because a group does not generally generate alternatives, and thus broaden the scope, but is somehow given a set of alternatives. *Brainstorming* does not involve a specific technique to enhance problem abstraction and does not involve problem analysis, and so it is rated *low*. The use of key words from the original formulation of a problem in *analogy* and *attribute association*, which ensures some relations between the analogy or association problem with the original problem, at the same time sets perceptual boundaries. For example, an analogy to a difficulty is usually another difficulty (as opposed to an opportunity) and a spatial problem is likely to generate attributes that direct thinking to increasing the productivity of the space given the same demand, rather than reducing the demand itself. For this reason, these methods are ranked *medium. Nominal Group Technique* and *Delphi* are also rated *medium* because they include careful preparation of a questionnaire for the group to respond to which implies the development of problem abstraction. *Disjointed incrementalism, matrix evaluation, goal programming, conjoint analysis, outranking, Bayes, MAUT/MAVT, and AHP* do not involve a technique to broaden problem abstraction, but since analysis enhances problem abstraction, they are rated *medium*. Also *outranking, Bayes, MAUT/MAVT, and AHP* are rated *medium* because they are assumed to apply techniques such as *NGT* or *Delphi* which are rated *medium. Morphological analysis* is rated *high* because of its systematic search for combinations of attributes that produce candidates for alternatives. *Why-what's stopping* is also rated *high* because its *why's* questions uncover the assumptions underlying the difficulties in implementing the suggested solutions identified by the *what's (how's)* questions. Structuring the responses to the repeated questions provides highly comprehensive relationships among problems, subproblems, and alternative courses of action. *Boundary examination* systematically challenges the underlying assumptions regarding the problem, hence it is also rated *high*.

4. Problem abstraction: development of alternatives

Analogy and *attribute association, boundary examination, matrix evaluation, goal programming, conjoint analysis,* and *Bayes analysis* are rated *low* because identifying alternatives is not an explicit part of the method. *Brainstorming/brainwriting* is rated *medium* because it ensures a free-wheeling environment but does nothing to take advantage of the positive aspects of interaction among group members. This method assumes that an alternative ranked high by the group is the most relevant solution to the problem, which may not be generally true because the group does not get to bring out possible disadvantages to the suggested alternatives. This weakness is inherent in brainstorming as well as in its modifications, e.g., brainwriting (generating ideas in writing), bug list and negative brainstorming (generating complaints to identify weaknesses). Crawford's blue slip method (independently brainstorming in response to a number of questions that are related to a problem) does not tell one how to organize the information. Brainstorming addresses the negative aspect of communication by removing interaction from the decision process, at the cost of taking advantage of its positive aspects. This may be the reason why this popular method is observed as the least effective

technique [Couger, 1995]. *Disjointed incrementalism* is also rated *medium*, but because it generates incremental alternatives rather than distinct ones. *Nominal Group Technique (NGT)* and *Delphi* are rated *high* because a certain degree of alignment of group member's perceptions takes place. *Outranking* and *MAUT/MAVT* are also rated *high*, the same as NGT and Delphi, because the complexity of the problem approached using these methods is assumed to require an application of either one of the two alternative generating methods. *Morphological connection* is mostly useful for new product or new system development, and is rated *very high* under development of alternatives. *Why-what's stopping* is also rated *very high* because the outcome of this method is a highly comprehensive view of the problem and its subproblems, with alternative courses of action included. One potential problem may be that presenting such a broad and detailed analysis may be quite a challenge. *AHP* is rated *very high* because, although it may begin with brainstorming as to what alternatives should be located at the bottom of the hierarchy, the level of problem abstraction represented by its hierarchy of criteria provides the opportunity to question whether or not the alternatives that are known indicate appropriate breadth for that level of abstraction.

5. Structure: breadth

This indicator does not apply to *analogy/association, boundary examination, brainstorming/brainwriting, and morphological connection, voting, conjoint analysis,* and *Bayesian analysis*. *NGT* and *Delphi* are rated *low* because they are direct comparison methods. *Why-what's stopping, disjointed incrementalism, matrix evaluation, outranking, MAUT/MAVT,* and *AHP* are rated *high* because they do not limit the number of criteria or factors considered in the analysis.

6. Structure: depth

This indicator does not apply to *analogy/association, boundary examination, brainstorming/brainwriting, morphological connection, voting, conjoint analysis,* and *Bayesian analysis*. *NGT* and *Delphi* are rated *low* because they are direct comparison methods. Lack of measurement and of theoretical foundation for *disjointed incrementalism* and *matrix evaluation* prevent them from constructing a deep structure, hence they are rated *low. Goal programming, outranking,* and older *MAUT* are rated *low* because they have no provision for subcriteria. *Why-what's stopping* and *AHP* are rated high because they do not limit the level of detail of the analysis with respect to breaking down criteria into subcriteria, sub-subcriteria and so on.

7. Analysis: faithfulness of judgments

This indicator, and all others here, do not apply to *analogy/association, boundary examination, brainstorming/brainwriting, morphological connection,* and *why-what's stopping*. *NGT* and *Delphi* include a voting process to determine which alternative is preferred by the majority of the group members. However, there is an opportunity to use them together with a ratio scale evaluation method like the AHP. *Voting* is rated *low* because it uses an ordinal scale. *Disjointed incrementalism, matrix evaluation,* and *outranking* are rated *medium* because they involve assigning numbers which can be assumed to represent intensity of importance better than the ordinal rating of voting, for example. *MAUT/MAVT* is rated *high* because intensity of preference is derived from lottery judgments which are once removed from direct elicitation of preferences, and *AHP* is rated *very high* because it elicits elementary judgments.

8. Breadth and depth of analysis (analysis)

Voting is rated *low* because it involves judgment, but not analysis. *Disjointed incrementalism, matrix evaluation, goal programming, conjoint analysis,* and *Bayesian analysis* are rated *medium* because they are structurally constrained. *MAUT/MAVT* is rated *high* because it provides more structural flexibility but it is difficult to go back and review previous analysis. The AHP is rated *very high* because its structural flexibility facilitates in-depth analysis of a problem. It also provides inconsistency and incompatibility measures to indicate if some improvement in judgments, and some effort to align perceptions among group members are required. Its supporting software provides the information as to where the sources of inconsistency and incompatibility are.

9. Fairness: cardinal separation of alternatives

This indicator is applicable only to *voting, outranking, MAUT/MAVT*, and *AHP. Voting* is rated *low* because it uses an ordinal scale, and the others are rated *high* because they use cardinal scales. Arrow's theorem indicates that any ordinal preference relation, be it expressed as a set of pairwise comparisons or point allocations, does not treat the alternatives fairly.

10. Fairness: prioritizing group members

This indicator is also applicable only to *voting, outranking, MAUT/MAVT*, and *AHP. Voting* is rated *low* because fairness is operationalized using head counting with no regard to intensity of preference, which has been argued as unsatisfactory [Dummett, 1984]. *Outranking* and *MAUT/MAVT* treat individual members of the group equally. They may in fact, implicitly give them unequal weights, as for example, by giving the boss's opinion greater accord than that of other members of the group in constructing their measures, but the lack of method requires that the relative weights can only be assigned rather arbitrarily. With the *AHP*, it is at the decision-maker's discretion to determine what concept of fairness is appropriate. A hierarchy can be structured, with the different individuals at the bottom of the hierarchy. The criteria levels may include area of responsibilities or expertise that can be used to prioritize the individuals.

11. Fairness: consideration of other actors and stakeholders

This indicator is not applicable to *analogy/association, boundary examination, brainstorming/brainwriting*, and *morphological connection* because they do not involve problem analysis. It is unlikely that this indicator would be applicable to *Bayesian analysis* because of its complex cause-effect relationship with the states of nature, hence it is rated *low. Conjoint analysis* is rated *low* because it may be possible for a creative user to represent other actor's concerns in its model. *NGT* and *Delphi* are rated *low* because they do not make explicit this concern, which might be made implicit by individual members of the group. *Matrix evaluation* is rated *low* because of its highly constrained structural representation and non-quantifiable analysis. *Outranking* is rated *low* because it obtains a decision with incomplete information, and its theoretical foundation is not yet settled even for the most fundamental issues, making it unlikely that this concern would be addressed and settled once and for all. *MAUT/MAVT* is rated *low* because, although it may incorporate this concern as one of its criteria, its limited structural representation makes it difficult to address the possible diversity of actors. *Why-what's stopping* and *disjointed incrementalism* may address the issue explicitly, but qualitatively, and are rated *medium*. It appears that the *AHP* is the only method that facilitates for a group to explicitly include other actor's concerns in detail as parts of the problem structure, and quantify them, hence it is rated *high*.

12. Scientific and mathematical generality

This indicator is not applied to *analogy/association, boundary examination, brainstorming/brainwriting, morphological connection, why-what's stopping, NGT, Delphi*, because they do not involve problem analysis. *Disjointed incrementalism* and *matrix evaluation* are rated *low* because they do not involve mathematics. *Voting* is rated *medium* because there are many procedures proposed for aggregating ordinal votes, with or without axiomatization. The ones that are axiomatized are usually mathematically complex to deal with the impossibility inherent in ordinal group aggregation. *Goal programming*, and *conjoint analysis* are rated *medium* because they do not involve axiomatization. *Outranking* is rated *medium* because it is not yet axiomatized. *Bayesian Analysis,* and *MAUT/MAVT* are rated *high* because they are axiomatically solid but their generalization's have considerable mathematical difficulties. The AHP is rated *very high* because its mathematical foundation is generalizable without additional assumptions.

13. Applicability to intangibles

This indicator is not applied to *analogy/association, boundary examination, brainstorming/brainwriting, morphological connection, why-what's stopping, NGT, Delphi*, and *voting* because they do not involve problem analysis. *Disjointed incrementalism* and *matrix evaluation* are qualitative methods and are rated *low*. *Goal programming* and *conjoint analysis* may incorporate intangibles in their model, but they must be represented by tangibles with absolute measurement, hence they are rated *medium. Outranking* and *MAUT/MAVT* are rated *medium* because they must use absolute measurement. *Medium* is probably a generous judgment because *MAUT* is riddled with unresolved paradoxes and problems and "the standard theory is being challenged on several grounds from both within and outside economics [Machina, 1987]." *Bayesian analysis* deals with the probability of events, and is rated *medium* because it often contrives and guesses at its prior probabilities without adequate scientific justification. *AHP* is rated *very high* because its fundamental measurement ensures its applicability to intangibles naturally, that gives discretion to the user whether to use relative, ideal or absolute measurement [Saaty, 1990].

14. Psychophysical applicability

Psychophysical applicability does not apply to *voting, goal programming,* and *conjoint analysis. Disjointed incrementalism, matrix evaluation* and *Bayes analysis* are rated *low* because psychophysical law is irrelevant. *Outranking* and *MAUT/MAVT* are rated *medium* because they generally do not incorporate the psychophysical phenomenon. If they do, it would complicate the mathematical representation of the theory considerably. *AHP* is rated *high* because in many examples, its priority scales approach has produced measurement of responses to physical stimuli that corresponded closely to the normalized values of physical measurement of those stimuli in the homogeneous ranges in which they were examined.

15. Applicability to conflict resolution

There are only two theories applicable to conflict resolution, game theory which is based on the utility theory, and the AHP. They are both rated *medium.*

16. Validity of the outcome (what if)

This indicator is not applied to *analogy/association, boundary examination, brainstorming/brainwriting, morphological connection, why-what's stopping, NGT,* and *Delphi,*

because they do not involve problem analysis. *Voting* is rated *low* because it uses ordinal measurement with no problem representation, *Disjointed incrementalism* and *matrix evaluation* are rated *medium* because they are limited in terms of measurement and model representation, *Goal programming, conjoint analysis,* and *Bayes analysis* are rated *medium* because their main concern is with computation, not with problem representation. *Outranking* and *MAUT/MAVT* are rated *medium* because they use cardinal measurement with a relatively simplified model representation. *AHP* is rated *high* because its reliance on ratio scales derived from paired comparisons, enabling one to model a problem by ordering its elements and levels in a fine, structured way to legitimize the meaningfulness of the comparisons, and also because different ratio scales can be multiplied and divided to obtain an outcome from hierarchies of benefits, costs, risks, and opportunities.

Research indicates that sometimes a method does not perform as intended. For example, instead of directing decision makers to profitable investment, a series of experiments indicate that the use of the Boston Consulting Group (BCG) matrix increases the subject's likelihood of selecting less profitable investment [Armstrong and Brodie, 1994] due to misuse of the method [Wensley, 1994].

6.5 Discussion

An AHP model shown in Figure 6.1 was developed to obtain an overall rating of the methods, but no numbers are included in it. Our intention is to offer an opportunity for evaluating the methods to the reader. We must confess that we are not entirely unbiased in our preference and hence we have avoided trying to be too explicit. This exercise provides an example of the absolute rating approach of the AHP to do ranking. The reader would have to use numbers to represent his or her judgments according to the fundamental scale of the AHP. Table 6.2 gives the criteria and the intensities for each criterion together with their local priorities. We believe that we have thought through carefully about the relative importance of the intensities for each criterion that they may be of use to an individual who wants to establish priorities for the criteria, and then select the appropriate intensity for each method on each criterion and then obtain the total for that method.

We would like to note that not every decision problem needs to be analyzed in a comprehensive and elaborate way as one does with the AHP. We see two kinds of problems. Simple ones that do not require a great deal of deliberation or the need to justify to someone else or to maintain a record. For such problems one often does not stop to consciously structure the decision and only uses brief flashes of thought to make trade-offs without a need for arithmetic. In such cases even if the decision is not optimal, one soon forgets the incident and goes on to make the same kind of decisions in the same or in a modified way without a feeling of inadequacy. One may refer to this kind of decision making as a single overall criterion decision, or decision making in bulk. Such decision making is often done with the aid of straight brainstorming.

The other kind of decision is the one we have discussed in this dissertation that requires detailed analysis with structure and judgments and a methodology to deal with tangibles and intangibles, benefits and costs and the like. The proponents of these methods will argue that their method is best for this or that reason, and the debate, if ever, will be eventually settled empirically and also on theoretical grounds when there is sufficient understanding of the field that mathematicians will be able to determine the correctness and accuracy of the various claims. The AHP is a tried and tested tool for that purpose. Whenever one has to make numerical trade-offs among the criteria and among the alternatives, the problem of the scale origin of the numbers becomes preeminent. In that case, proponents of different techniques must show that all the operations they perform on their numbers, preserve their integrity. With the exception of the AHP and its derived (not assumed) ratio scales from judgments of homogeneous elements based on an absolute Fundamental Scale, the question of what kind of number represents the very final decision has been the Achilles' heel of multicriteria decision making.

6.6 Efficiency

The efficiency of a process is very dependent on how it is organized and on its leader and could not be used as one of the criteria. Nevertheless, it is an important consideration. Here we discuss how a facilitator can ensure group efficiency with the AHP. The AHP makes group decision making intrinsically efficient for at least three reasons: (1) it provides a framework and tools for group collaboration that systematize the group process, (2) it enables the group to break its task into distinct sub-tasks, with each managed almost independently with respect to the manpower allocated and to the group techniques used, and (3) it provides feedback measures to facilitate judgment improvement while allowing a certain degree of inconsistency in the judgments. The fact that the AHP involves redundancy in judgments, does not make it an inefficient method, because one can always choose to do quick and dirty evaluation by eliminating redundancy, although one may get an inaccurate result. A facilitator can enhance group efficiency as follows:

(1) <u>Divide group task to minimize man-hour utilization</u>

Group decision making is said to be efficient if it consumes a reasonable amount of resources, mainly in terms of the time and number of people involved. Research indicates that groups are relatively more costly when measured by the man-hours spent. The larger the group size, the more the hours spent by each person [Shaw, 1932; Taylor and Faust, 1952; Marquart, 1955], hence the smaller the group size, the more efficient the group process. The AHP enables a group to reduce the amount of time spent by its members by:

(a) Breaking the group task down into a set of sub-tasks: constructing a hierarchy or parts of a hierarchy, providing judgments for a given hierarchy or parts of a hierarchy.

(b) Determining the smallest number of people possible to complete each sub-task. If one person can do a job well, no need to assign a team to do the job. However, fair distribution of tasks needs to be considered.

(c) Allowing reduced number of judgments (see Chapter 5).

(d) Allowing an acceptable level of inconsistency.

(e) Improving judgments by looking for both the most inconsistent judgment and the individual that causes it.

However, for group decision-making, efficiency is also manifested in how well the group process moves, does not get bogged down, and gets to the point. Pursuing efficiency is an achievement orientation goal. Sometimes, the concern for the maintenance goal may require that the effort towards greater efficiency be somewhat relaxed: assigning more people than is necessary, allowing lengthy discussion on important matters, or organizing expert presentations rather than asking them to make judgments for the group.

(2) <u>Use the underlying intentions of deferred judgment and structured communication.</u>

The AHP generalizes the application of the concepts of deferred judgment in brainstorming, and structured communication in the NGT. It separates the process of problem structuring (which in turn consists of two distinct processes of identifying the elements of the problem and of defining dominance relations), judgment elicitation, and evaluation. The group can conduct brainstorming, NGT, or Delphi sessions to identify alternatives and criteria efficiently.

During problem structuring, differences with regard to structuring the hierarchy do not need to be

resolved. This is a win-win kind of disagreement. The group effort should be focused on establishing dominance relations among elements rather than arguing too early whether or not an element should or should not be in a hierarchy. If some elements do not fit logically in a hierarchy, consider another hierarchy. For example, cost criteria cannot be logically located in the same hierarchy with benefit criteria. Facilitate efficiency in judgment elicitation by ensuring an optimal size of the hierarchy. If the structure is too deep, encourage the group to remove some of its levels and learn later whether or not the resulting ambiguity creates difficulties in judgment elicitation.

During judgment elicitation, obtaining a pairwise comparison judgment should be the end of a discussion. For example, if the group agrees that a criterion is strongly more important than another, the members do not have to agree on the reasoning behind the judgment.

(3) Balance between consensus and voting

What makes conventional group decision making demanding is that it is expected to reach consensus on which alternative(s) to select, although the group may generally agree on the criteria and their relative importance. It is reasonable to assume that it would be easier to reach consensus on comparing two things than on many things at once. The AHP makes it even easier by not requiring a group to reach consensus on a judgment. If voting is necessary for reasons of efficiency, its effect must be minimized. Voting indicates an individual's incompatibility with the group and may lead to judgment inconsistencies. A narrow range of judgments can be ensured by discussing the differences first and selecting the appropriate individuals to vote. In fact, disagreement and incompatibility between an individual and the group provides an opportunity for organizational learning. The majority are not always right.

6.7 Conclusion

This chapter has provided us with a challenging opportunity to bring many criteria and many methods under one umbrella, which again illustrates the simplicity and practicality of the AHP to deal with intangibles and with a wide-ranging set of alternatives. We believe that our schematization is a good start and may eventually be improved upon in subsequent revisions and extensions of the criteria used and in debating the importance of these criteria.

APPENDIX E

LEVEL OF INTENSITIES

LEVELS OF INTENSITIES

The following preliminary intensity levels indicate the relative level of importance/ preference/likelihood of the pair-wise comparison between the various intensity choices within a single (sub) objective. These weights are also known as 'local weights'. These initial set of weights were derived using AHP before data collection and serve as a starting point for the evaluation of data. It is likely that these weights will change after more information is obtained during data collection

For the first objective (Compatibility), the pair-wise comparison, the local weights, and the inconsistency ratio is shown. For the other objectives, only the final local weights are summarized in tabular form.

1. BENEFIT OBJECTIVES

TECHNICAL OBJECTIVES

- *Compatibility (COMPATIBL)* – Compatibility of system with existing information systems

COMPATIBL	DEFINITION	LOCAL
H_Compat	High Compatible	.483
M_Compat	Moderate Compatible	.272
B_Compat	Barely Compatible	.157
N_Compat	Not Compatible	.088

Allocate Resources to Telemedicine Projects (Peacetime) - Benefit

Node: 11000

Compare the relative PREFERENCE with respect to: COMPATBL < TECHNICL < GOAL

1=EQUAL 3=MODERATE 5=STRONG 7=VERY STRONG 9= EXTREME

		9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	
1	H_Compat																		M_Compat
2	H_Compat																		B_Compat
3	H_Compat																		N_Compat
4	M_Compat																		B_Compat
5	M_Compat																		N_Compat
6	B_Compat																		N_Compat

Abbreviation	Definition
Goal	Allocate Resources to Telemedicine Projects (Peacetime) - Benefit
TECHNICL	Technical Aspects of the initiative
COMPATBL	Compatibility with existing information systems
H_Compat	System is highly compatible with existing IM/IT infrastructure
M_Compat	System is moderately compatible with existing IM/IT infrastruct.
B_Compat	System is barely compatible with existing IM/IT infrastructure
N_Compat	System is not compatible with IM/IT infrast w/o large amt of work

H_Compat	.483
M_Compat	.272
B_Compat	.157
N_Compat	.088

Inconsistency Ratio = 0.01

- **Multiple Usage (MULT_USE)** – Multiple uses of the same equipment

MULT_USE	DEFINITION	LOCAL
M4_USE	4 or more uses	.483
3_USE	3 uses	.272
2 USE	2 uses	.157
S_USE	Single Use	.088

- **Reliability (RELIABLE)** – Reliability of the system

RELIABLE	DEFINITION	FAILURE RATE	LOCAL
H_Reliab	Highly reliable	> 1x / month	.483
M_Reliab	Moderately reliable	1x / biweekly to 1x/ month	.272
B_Reliab	Barely reliable	1x/ week to 1/ biweekly	.157
N_Reliab	Not reliable	<1x/ week	.088

- *Performance (PERFORM)* – Performance level of the system

PERFORM	DEFINITION	LOCAL
E_Perfm	Excellent performance	.483
G_Perfm	Great performance	.272
A_Perfm	Acceptable performance	.157
B_Perfm	Barely performed	.088

- **Standards (STANDRDS)** – Meeting the established standards (transmission, records, etc.) such as HL7, DICOM, TCP/IP, H2x.

STANDRDS	DEFINITION	LOCAL
A_Std	Met all standards	.483
M_Std	Met most standards	.272
S_Std	Met some standards	.157
N_Std	Met none of standards	.088

- **Speed (SPEED)** – Speed of transmission (Available bandwidth)

SPEED	DEFINITION	LOCAL
ATM	ATM	.440
T1	T1	.256
ISDN	ISDN	.156
Telephn	Telephone	.091
S_Modem	Slow Modems	.058

LEGEND
Italic objectives – qualitative
Bold objective - quantitative

- *Upgrade (UPGRADE)* – Ease of system upgrades

UPGRADE	DEFINITION	LOCAL
Ease_UG	Easy to upgrade	.540
M_UG	Moderately easy to upgrade	.297
N_UG	Not upgradeable	.163

BUSINESS OBJECTIVES

- *Ease of Use (EASE USE)* – Ease of use of system

EASE USE	DEFINITION	LOCAL
V_Easy	Very easy to use	.483
M_Easy	Moderately easy to use	.272
N_Easy	Not easy to use	.157
VD_Easy	Very difficult to use	.088

- *Integration (INTEGRTE)* – Integration with existing IM/IS Infrastructure

INTEGRTE	DEFINITION	LOCAL
F_Integr	Fully integrated	.540
D_Integr	Demo mode only	.297
N_Integr	Not integrated	.163

- **Market penetration (MARKETP)** – Market penetration (use of technology/total number of uses)

MARKETP	DEFINITION	LOCAL
1 YR Ago	MP 1 year ago	.483
Today	MP today	.272
1YR Futr	Est. 1 year MP	.157
>1YR FR	Est. >1 year MP	.088

- **Measures of Performance (MOP)** – Does the initiative have a clearly written measures of performance?

MOP	DEFINITION	LOCAL
Y_MOP	Have MOPs	.800
N_MOP	Do not have MOPs	.200

LEGEND
Italic objectives – qualitative
Bold objective - quantitative

- **Patient (PATIENT)** – Primary patient population

PATIENT	DEFINITION	LOCAL
AD_PT	Active duty	.483
DEP_PT	Dependents	.272
RET_PT	Retirees	.157
OTHER_PT	Others	.088

- *Political (POLITICAL)* – The political support for the initiative

POLITICAL	DEFINITION	LOCAL
H_Supprt	Highly supported	.540
M_Supprt	Moderately supported	.297
N_Supprt	Not supported	.163

- **Plan (PLAN)** – Does the initiative have a written business or project management plan?

PLAN	DEFINITION	LOCAL
Y_Plan	Have a plan	.800
N_Plan	Do not have a plan	.200

- **Usage Level (USGE_LVL)** – The level of system usage

USAGE_LVL	DEFINITION	LOCAL
H_Used	High usage level	.483
M_Used	Moderate usage level	.272
A_Used	Acceptable usage level	.157
B_Used	Barely used	.088

DELIVER OF CARE (CARE) OBJECTIVES

- **Approvals (APPROVL)** – Approval of system by review board(s) and/or FDA

APPROVL	DEFINITION	LOCAL
YES_Appr	Approval obtained	.540
OG_Appr	Approval on-going	.297
N_Appr	Not approved	.163

LEGEND
Italic objectives – qualitative
Bold objective - quantitative

- *Efficiency (EFFICNCY)* – Efficiency in quality of care

EFFINCY	DEFINITION	LOCAL
HI_Effic	Highly improved	.483
MI_Effic	Moderately improved	.272
BI_Effic	Barely improved	.157
NI_Effic	Not improved	.088

- **Quality (QUALITY)** – Quality of care

QUALITY	DEFINITION	LOCAL
HI_Qual	Highly improved	.483
MI_Qual	Moderately improved	.272
BI_Qual	Barely improved	.157
NI_Qual	Not improved	.088

- *Safety (SAFETY)* – Safety of equipment/procedure

SAFETY	DEFINITION	LOCAL
CS_Safe	Completely safe	.540
AS_Safe	Assumed safe	.297
N_Safe	Not safe	.163

- *Satisfaction (SATISF)* – Patient satisfaction level with procedure/system/technology

SATISF	DEFINITION	LOCAL
V_Sat	Very satisfied	.483
M_Sat	Moderately satisfied	.272
B_Sat	Barely satisfied	.157
U_Sat	Unsatisfied	.088

- **Security (SECURE)** – Patient privacy, information security and confidentiality

SECURE	DEFINITION	LOCAL
C_Secure	Completely secure	.540
B_Secure	Barely secure	.297
U_Secure	Unsecure	.163

LEGEND
Italic objectives – qualitative
Bold objective - quantitative

2. COST OBJECTIVES

TECHNICAL OBJECTIVES

- **Maintenance (MAINTAIN)** – Maintenance requirements of the system

MAINTAIN	DEFINITION	MEAN TIME BETWEEN FAILURE	LOCAL
L_Maintn	Low maintenance	> 1x / month	.483
A_Maintn	Acceptable maintenance	1x/ biweekly to 1/month	.272
M_Maintn	Moderate maintenance	1x/ week to 1/ biweekly	.157
H_Maintn	High maintenance	>1x / week	.088

- **Size (SIZE)** – Size of the Equipment

SIZE	DEFINITION	LOCAL
Neg_Sz	Negligible Size	.483
Port_Sz	Portable	.272
Tr_Sz	Transportable	.157
Fixed_Sz	Fixed	.088

- **Weight (WEIGHT)** – Weight of the equipment

WEIGHT	DEFINITION	POUNDS	LOCAL
VL_Wt	Very light weight	< 10 lbs.	.440
L_Wt	Light weight	10-20 lbs.	.256
A_Wt	Acceptable weight	20-50 lbs.	.156
Mod_Wt	Moderate weight	50-100 lbs.	.091
Heavy_Wt	Heavy weight	> 100 lbs.	.058

- *Assembly (ASSEMBLY)* – Level of difficulty in assembling the equipment

ASSEMBLY	DEFINITION	LOCAL
E_Asmbly	Easy to assemble	.540
M_Asmbly	Moderately easy to assemble	.297
D_Asmbly	Difficult to assemble	.163

LEGEND
Italic objectives – qualitative
Bold objective - quantitative

- **Customization (CUSTOM)** – Customization level of the equipment

COSTOM	DEFINITION	LOCAL
COTS/GOTS	Commercial/Government off-the-shelf	.483
ENH_COTS	Enhanced COTS	.272
CUS_EQ	Custom equipment	.157
PROTOTYP	Prototype	.088

BUSINESS OBJECTIVES

- **Facility (FACILITY)** – Facility Requirements

FACILITY	DEFINITION	SQUARE FT	LOCAL
N_FloorS	No floor space	No floor space - Desktop	.440
S_FloorS	Some floor space	< 100 sq ft	.256
M_FloorS	Moderate floor space	100-500 sq ft	.156
L_FloorS	Large floor space	> 500 sq ft	.091
Ded_Fac	Dedicated facility	Dedicated facility	.058

- **Initial Capital Requirements (ICAPITAL)** – Initial capital investments

ICAPITAL	DEFINITION	COST $	LOCAL
VS_ICAP	Very small initial capital	< $10K	.440
S_ICAP	Some initial capital	$10K-$100K	.256
M_ICAP	Moderate initial capital	$100K-$500K	.156
L_ICAP	Large initial capital	$500K -$1M	.091
VL_ICAP	Very large initial capital	$1M	.058

- **On-going Capital Requirements (OCAPITAL)** – On-going monthly capital investments

OCAPITAL	DEFINITION	COST $	LOCAL
VS_OCAP	Very small on-going capital	< $5K	.440
S_OCAP	Some on-going capital	$5K-$10K	.256
M_OCAP	Moderate on-going capital	$10K-$25K	.156
L_OCAP	Large on-going capital	$25K -$50K	.091
VL_OCAP	Very large on-going capital	$50K	.058

LEGEND
Italic objectives – qualitative
Bold objective - quantitative

- **Scheduling (SCHEDUL)** – Scheduling Requirements

SCHEDUL	DEFINITION	LOCAL
Y_Sched	Yes- scheduling required	.800
N_Sched	No scheduling required – on demand	.200

- **Training (TRAINING)** – Initial system training requirements

TRAINING	DEFINITION	# HOURS	LOCAL
VS_Trng	Very small level	< 1 hour	.440
S_Trng	Small level	1-4 hour	.256
A_Trng	Acceptable level	4-8 hour	.156
M_Trng	Moderate level	1-3 days	.091
L_Trng	Large level	> 3 days	.058

- **Transmission Cost (TRANS$)** – Monthly transmission costs

TRANS$	DEFINITION	$ PER MONTH	LOCAL
L_Transm	Low transmission $	< $100/m	.483
M_Tranm	Moderate transmission $	$100-$1K/m	.272
H_Transm	High transmission $	$1K-$5K/m	.157
VH_Transm	Very high transmission $	>$5K/m	.088

DELIVERY OF CARE (CARE) OBJECTIVES

- *Clinician Inconveniences (C_CONV)* – Level of clinician inconvenience

C_INCONV	DEFINITION	LOCAL
L_CIConv	Low clinician inconvenience	.540
S_CIConv	Some clinician inconvenience	.297
M_CIConv	Moderate clinician inconvenience	.163

- *Confinement (CONFINE)* – Patient confinement requirement (in room, in machine, etc.)

CONFINE	DEFINITION	LOCAL
L_Confn	Little confinement	.540
S_Confn	Some confinement	.297
M_Confn	Moderate confinement	.163

LEGEND
Italic objectives – qualitative
Bold objective - quantitative

- *Patient Delays (DELAY)* – Patient delays before, during, or after the TMED session

DELAY	DEFINITION	LOCAL
L_Delay	Little delay	.540
S_Delay	Some delay	.297
M_Delay	Moderate delay	.163

- *Patient Discomfort (DISCMFT)* – Level of patient discomfort

DISCOMFT	DEFINITION	LOCAL
L_Discmf	Low discomfort	.540
S_Discmf	Some discomfort	.297
M_Discmf	Moderate discomfort	.163

- Patient Inconveniences (P_INCONV) – Level of patient inconvenience

P_INCONV	DEFINITION	LOCAL
L_PIConv	Low patient inconvenience	.540
S_PIConv	Some patient inconvenience	.297
M_PIConv	Moderate patient inconvenience	.163

- *Patient Movement (MOVEMNT)* – Required patient movement

MOVENNT	DEFINITION	LOCAL
L_Move	Little movement	.540
S_Move	Some movement	.297
M_Move	Moderate movement	.163

LEGEND
Italic objectives – qualitative
Bold objective - quantitative

3.   RISK OBJECTIVES

- *Technical (TECH_RK)* – The failure to develop or procure any element, component, end-item, or subsystem

TECH_RK	DEFINITION	LOCAL
VH_T_RK	Very high technical risk	.440
H_T_RK	High technical risk	.256
M_T_RK	Moderate technical risk	.156
A_T_RK	Acceptable technical risk	.091
L_T_RK	Low technical risk	.058

- *Cost (COST_RK)* – Any variation in predicted costs that exceeds an acceptable level

COST_RK	DEFINITION	LOCAL
VH_C_RK	Very high cost risk	.440
H_C_RK	High cost risk	.256
M_C_RK	Moderate cost risk	.156
A_C_RK	Acceptable cost risk	.091
L_C_RK	Low cost risk	.058

- *Schedule Risk (RK)* – Failure to meet any pram milestone and/or complete any major event within an acceptable time

SCHED_RK	DEFINITION	LOCAL
VH_S_RK	Very high schedule risk	.440
H_S_RK	High schedule risk	.256
M_S_RK	Moderate schedule risk	.156
A_S_RK	Acceptable schedule risk	.091
L_S_RK	Low schedule risk	.058

LEGEND
Italic objectives – qualitative
Bold objective - quantitative

APPENDIX F

TECHNOLOGY PROFILE – 1ST DRAFT

Strategic Technology Planning for the U.S. Army Medical Department

Technology Profile

TELEMEDICINE

AMEDD Re-Engineering Laboratory (REL)   Toigo Associates, Inc.
12.4.97

INITIATIVE DESCRIPTION

1. Title of initiative:

2. Initiative leader/principal investigator:

3. Address:

4. Describe the initiative objectives:

5. Describe the technologies being used in this initiative:

6. Describe an application scenario:

7. Describe the current practice, and how the new technology will alter that practice:

8. Describe the plan for transitioning the initiative to widespread use (if any):

9. Describe the competing or alternative solutions and technologies:

10. Provide a flow diagram of the current practice:

11. Provide a flow diagram using the new process (technology):

12. At what sites is the initiative being *applied (specify primary and secondary)*:

13. Key personnel (*name, title, level of effort, status-AD/DOD civilian/contractor/other*) (**provide for each site**):

    Clinical leaders:

    Technical leaders:

    Administrative leaders:

    End users/customers:

14. Date initiative started:

15. Anticipated ending date:

16. What is the initiative status?

17. Who is the proponent?

18. Who is the sponsor?

19. Who is the end use?

    ☐ Individual (one per soldier)

       ☐ Combat arms

☐ Combat support and combat services support

☐ Team

☐ Unit (echelon 1 or 2)

☐ Unit (echelon 3 or 4)

☐ Sustaining base

20. Who are the fund providers?

21. What is the current funding for the initiative (*source, amount, and duration*)?

22. What remains to be done before the product/process is available for use (what will it take to develop and implement – R&DD requirements)?

23. What design, development, and implementation problems and barriers are anticipated?

24. How will these barriers affect availability?

25. What are the benefits of the technology (advantages)?

26. What are the risks of the technology (disadvantages)?

27. What are the limitations of the technology?

28. What are other uses for the technology?

☐ Within AMEDD

☐ Within MHSS

☐ External to DOD

29. What happens if the new technology is note developed or implemented?

30. How will the current business practice needs to be changed to accommodate the new technology?

31. Where will the technology be used?

32. Type of Technology

☐ Diagnostic

☐ Therapeutic

☐ Public Health

☐ Preventive

☐ Rehabilitative

☐ Administrative

33. Exportability

34. Current initiative use

35. Technology Source

☐ Non Developmental Item

    ☐ COTS

    ☐ GOTS

☐ Developmental

    ☐ Enhanced (customized) COTS/GOTS

    ☐ Custom ("one-of")

    ☐ Prototype

36. What is the current life cycle phase?

☐ DOD (non-programmatic)

☐ DOD Program

    ☐ 6.1

    ☐ 6.2

    ☐ 6.3

        ☐ 6.3a

        ☐ 6.3b

    ☐ 6.4

    ☐ 6.5

    ☐ P2

    ☐ P8

37. What is the role of AMEDD in this initiative?

☐ Researcher – determines fundamental knowledge related to the scientific or engineering field being investigated

☐ Developer – solves technical and engineering problems related to the production of a finished product

☐ System Integrator – combines products from multiple sources into a unique product, may add proprietary hardware or software to system

☐ Evaluator – conducts or participates in clinical or technical trials, including usability testing

☐ Advisor – provides clinical, military, or technical expertise to developers

☐ None

38. What is the anticipated value (benefit) of the technology?

☐ Keeps AD forces on the job

☐ Saves lives

☐ Keep beneficiaries at work or at home

☐ Reduces medical evaluation missions

☐ Reduces MHSS skill mix and size MHSS staffing model

☐ Maintain military readiness skills of MHSS staff

☐ Reduce health services requirements of TRICARE support contractors

☐ Enhance and measure health and fitness of beneficiaries

☐ Marketing

☐ Morale

39. What is the mission orientation for the initiative?

☐ Non Developmental Item

    ☐ Force initiation (combat)

    ☐ MOUT

    ☐ Peace operations

    ☐ Humanitarian assistance

    ☐ Garrison/sustaining base

☐ Beneficiary care

40. What benefit will the technology have for each mission? (anticipated distribution in percentage of total use)

OPERATIONAL ENVIRONMENT

☐ Disease Management (direct clinical care of DNBI)

☐ Combat Casualty Care (trauma management) reduce deaths, enhance ability to continue mission performance in wounded casualties)

    ☐ Battle injuries

    ☐ Combat stress

☐ WMD

☐ Preventive (Dx and prevent illness/injuries)

☐ Soldier Performance (performance monitoring, optimization)

☐ Education/Training

☐ Clinical Informatics (CIS, LIS, RIS)

☐ Logistical

☐ Administrative Support (C4I)

☐ Dental

☐ Veterinary

    ☐ Food Services

    ☐ Animal Care

☐ Laboratory

☐ Health Promotion

☐ Rehabilitation

BENEFICIARY CARE

☐ In MTF

☐ TRICARE

☐ Civilian (not TRICARE)

TECHNICAL

1.	What technologies are being applied? (describe each in detail)

☐ Hardware

☐ Software

☐ Process

☐ Computer

☐ Telecommunications

☐ Display

☐ Image processing

☐ Sensor

☐ Network devices

☐ Simulation and modeling

☐ Training

2.	What standards are used (e.g., HL7, DICOM, H32x, TCP/IP)?

☐ Device

☐ Software

☐ Networking

3.	What technologies must be in place or available for the initiative to work?

4.	What are the bandwidth requirements and load?

5.	What integration with telecommunications network has occurred?

☐ Military

☐ Civilian

6.	Who is the provider or the developer of the technology?

7.	Is the system technically sound?

8.	Is the proposed initiative technically feasible?

9.	What is the level of activity in competing approaches that would reduce the value of the technology being developed (e.g., improved training or behavioral changes)?

10.	What are the secondary technologies required to use this technology?

11. What is the weight/cube (footprint) of the technology being evaluated/of entire system)?

   ☐ Current

   ☐ Target

12. What is the compatibility with IM/IT systems?

   ☐ Existing

   ☐ Planned

13. What are the environmental implications?

   ☐ Power requirements and sources

   ☐ Personnel risks and hazards

   ☐ Environmental hazards

   ☐ Signature/exposure (physical/electronic)

14. What category is the technology?

   ☐ Disposable (single use)

   ☐ Limited re-use

   ☐ Durable

15. What is the reliability level (% times use successful/% time uses attempted)

16. What are the serviceability requirements?

   ☐ Routine

   ☐ Unscheduled

17. How are the technical support services provided?

MARKET

1. For what disease(s) or condition(s) will the technology be applied (IDC-0 or CPT codes)?

2. What is the incidence/prevalence for the disease (s) or condition(s)?

3. What fundamental value is added to the technology by AMEDD efforts and investments?

4. What value is added to AMEDD business practice by the technology?

5. What is driving the technology development?

    ☐ Investigator academic or clinical interests (investigator initiated)

    ☐ AMEDD Program (USAMRMC, AMEDD C&S, Others)

6. What is commercially available today?

7. What is the anticipated product life cycle?

8. What is the initial cost

9. What per unit cost seems attainable?

10. What is the long-term effect on organizational business practices?

11. What specialized training is required?

12. What level of personnel support is required?

13. What are costs of competing technologies?

14. What unique equipment is required?

15. What is the infrastructure costs?

16. What are the operating and maintenance costs per use and life cycle?

17. How often is the technology applied to each patient?

18. Are there disposables?

19. What is the level of customer awareness?

20. Are the customers risk averse?

21. What is the threshold level of investment (minimum necessary investment in development to ensure success)?

22. What is the total market size (# and $)?

    ☐ Army

    ☐ DOD

    ☐ Govt (non-DOD)

    ☐ Non-US Govt

    ☐ Commercial

        ☐ US

        ☐ International

23. Are there third party payers that will reimburse for this technology?

    ☐ Capital expenditure

    ☐ Use

PROPRIETARY

24. Who are the medical care providers that will be using this technology?

25. How will access to the technology be determined?

26. What concept of operations (doctrine) will be applied?

27. Intellectual property ownership:

☐ Government owned IP

☐ Royalty-free use

☐ Licensed use

☐ Academic IP

☐ Non-profit IP

☐ Industry IP

☐ No IP

☐ Unknown

☐ Shared IP

28. Level of technologies used

☐ Base/Core

☐ New (diffusion stage)

☐ Established

☐ Emerging

☐ Obsolete

☐ Idealized unknown basic technology

29. What are the enabling technologies required?

30. Impact on business process:

☐ Minor product or process improvement

☐ Major product or process improvement

☐ New to the market or process

☐ Breakthrough product or process (novel state-of-the-art)

31. Barriers to entry

☐ Developmental cost

☐ Unit cost

☐ Complexity

☐ Physician/medic resistance

☐ Patient resistance

☐ Immaturity

☐ Competing product or technology

32. FDA Regulatory status:

33. Acquisition status:

34. Implementation status:

35. Termination (obsolescence date):

36. What is the rate of adoption of the technology?

37. Diagram the technology acceptance life cycle?

38. Anticipated time to mainstream acceptance and use:

☐ Today (1997-2000)

☐ Transition (2000-2005)

☐ Force XXI (2005-2010)

☐ AAN (2010-2020)

☐ Army of the future (past 2020)

39. Customer base (market size):

☐ Number of users

☐ Number of units (devices)

☐ Number of uses/time unit

☐ Number of units in use now (devices, seat licenses)

☐ Total number of units needed (anticipated)

40. Market penetration (*customer using the technology/total number of customers*)

☐ Today

☐ Yr ago _____

☐ 2 Yr from now

☐ # of episodes in which technology is used/total # of episodes _____

PROPRIETARY

CLINICAL EVALUATION

Is there Clinical Evaluation being performed?

If Yes – initiative principal investigator to provide available data for profile:

1.   What specific data is being collected or is available?
2.   How is the data collected?
3.   What were the criteria for using the technology?
4.   Is there human subject study approval for the initiative/technology?
5.   Who is the approving IRB?
6.   What are inclusion criteria?
7.   What are exclusion criteria?
8.   How was the sample population selected?
9.   Total number of population with the condition or disease?
10.   Number of subjects lost to follow up
11.   What was the reason for the subject withdrawal?
12.   What study design was used?
13.   What study design was used?
14.   How ill QI/PI be performed?
15.   How is informed consent obtained?
16.   What standards of care will be applied?
17.   What are the risks of the technology?
18.   What are the liability implications?
19.   What statistical methods were applied (specific tests or techniques)?
20.   Was the effect of technology application adjusted for covariates?
21.   What clinical end points were used to judge success of the technology?
22.   How many independent observers evaluated the endpoints?
23.   To what standard was the technology compared ("gold standard")
24.   Was the technology evaluated over a broad spectrum of patients?
25.   Over what period of time were results evaluated (patients followed)?

26. Were technical problems recorded?

27. What was the sensitivity/specificity/PPV/NPV/accuracy/reproducibility?

28. Are there other studies using the same or similar technologies?

29. How effective is the technology (what is the probability of benefit to individuals in a defined population when the technology is applied to a given medical problem under conditions of average use? Of ideal use)?

30. Did any patients discontinue the use of the technology?

31. What were the effects of telemedicine application on the clinical process of care compared to the alternative (s)?

32. What were the effects of telemedicine application on immediate, intermediate, r long-term health outcomes compared to the alternatives?

33. Did telemedicine affect the use of services or the level of appropriateness of care compared to the alternative?

34. Did the application affect the timeliness of care or the burden of obtaining care compared to the alternatives?

35. What were the costs of the telemedicine application for participating health care providers or health plans compared to the alternatives?

36. What were the costs of the telemedicine application for patients and families compared to the alternatives?

37. What were the costs for society overall compared to the alternatives?

38. How did the costs of the application relate to the benefits of the telemedicine application compared with the alternatives?

39. Were patients satisfied with the telemedicine service compared to the alternatives?

40. Were attending/consulting clinicians satisfied with the telemedicine compared with the alternatives?

ENVIRONMENT (Clinical, Military, Policy, Regulatory, Ethical, and Social)

1. Is such a technology acceptable to users within the context of use?

2. Are there social considerations involved in the application of the technology?

3. Will the technology increase or decrease demands on the healthcare system?

4.   What are the ethical considerations in the use of the technology?

5.   Is the technology used as anticipated?

6.   Does the technology produce the desired results?

7.   Does the technology work better than the procedure it replaced?

8.   Describe the education and training necessary for use of the technology:

9.   How well must individuals be trained to effectively use the system?

10. How well have individuals actually been trained?

11. To what extent does value of this technology depend on practice setting?

12. In what population is the technology applied most effectively?

13. What are the impacts on the healthcare system at large?

14. Did any medical personnel refuse to use or discontinue the use of the technology?

APPENDIX G

TECHNOLOGY PROFILE – 2$^{\text{ND}}$ DRAFT

Re-Engineering Laboratory (REL)

Strategic Technology Planning for the U.S. Army Medical
Department

Technology Profile

TELEMEDICINE

Process Outline
User Survey
Technology Profile

Technology Profile Process

Telemedicine

Identify Initiatives   AMEDD C&S

User Survey   Initiative POC

Brief and Site Visit   REL Team

Review and Follow-up   REL Team
Initiative POC

Market Evaluation → **Initiative Analysis**   REL Team
AMEDD C&S

REL Team
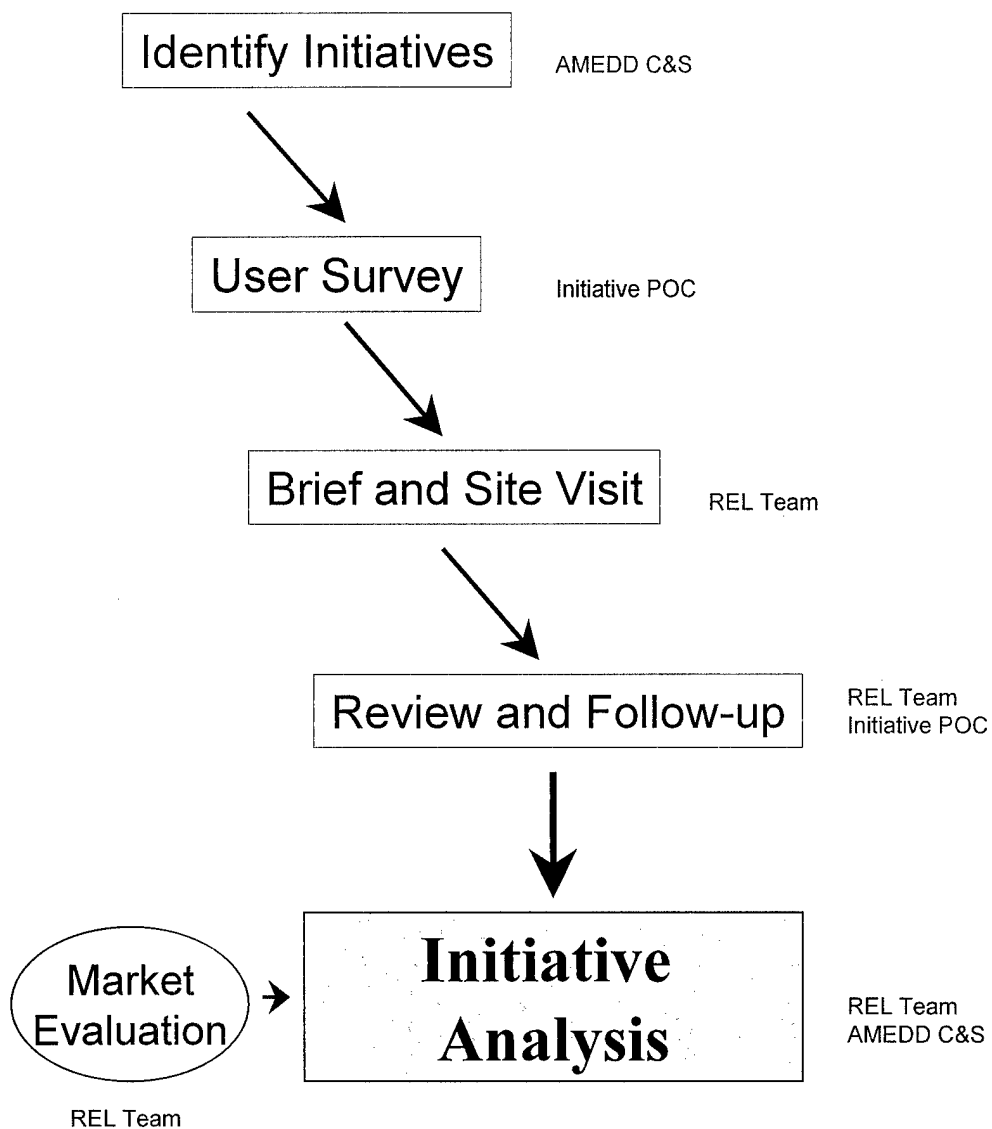
Telemedicine Initiative

User Survey

To be completed by initiative site and returned before briefing and site visit

Title of initiative:

Point of contact:
Name:
Title:
Address:
Telephone:
FAX:
Email:
URL:

Initiative proponent or sponsor:

Description of initiative:
describe the overall objective, current practice or approach, limitations of current practice that will be addressed by the new technology, and method for using the new technology

Application scenario:
provide one or more examples of use, focusing on the clinical environment, when appropriate

List sites at which the technology will be used:

Timeline of initiative:
date work started, date of first clinical use, date of full implementation, anticipated length of project

Accomplishments to date:

System components:
list hardware, software, networking, telecommunications requirements)

Telemedicine Initiative
Technology Profile

To be completed by the REL Team

MISSION

1. Category of Technology

% time used for each

Direct clinical care:
- ❑ diagnostic _____
- ❑ therapeutic _____
- ❑ preventive _____

Non-clinical use:
- ❑ administrative _____
- ❑ education/training _____
- ❑ health promotion _____
- ❑ logistical _____
- ❑ marketing/improve morale _____

2. Application Environment

Combat casualty care
- ❑ reduce battlespace deaths(KIA) _____
- ❑ reduce evacuations _____
- ❑ reduce combat stress _____

Keep AD forces on job
- ❑ disease management (DNBI) (deployed) _____
- ❑ disease management (DNBI) (sustaining base) _____

- ❑ Preventive (deployed) _____
- ❑ Preventive (sustaining base) _____
- ❑ Humanitarian assistance (non-DOD beneficiary) _____
- ❑ Sustaining base (beneficiary care) _____
- ❑ Reduce MHSS skill mix and staffing _____
- ❑ Reduce health service requirements of TRICARE support contractors _____
- ❑ Keep beneficiaries at work or home _____

3. End User

☐ Individual
   ☐ Combat arms   _____
   ☐ Combat service support   _____
☐ Unit (Echelon 1-2)   _____
☐ Unit (Echelon 3-4)   _____
☐ Sustaining base (Echelon 5, CONUS)   _____

4. Role of AMEDD in this initiative

☐ **Researcher**
determines fundamental knowledge related to the scientific or engineering field being investigated

☐ **Developer**
solves technical and engineering problems related to the production of the finished product

☐ **Systems Integrator**
combines products from multiple sources intoa unique product, may add proprietary hardware or software to system

☐ **Evaluator**
conducts or participates in clinical or technical trials, including usability testing

☐ **Advisor**
provides clinical, military, or technical expertise to developers

☐ **None**

5. Initiative Driver

☐ **Investigator-initiated** (investigator academic or clinical interests)
☐ **Centrally directed** (USAMRMC, DOD-HA, AMEDD C&S, etc.)

6. How is access to the initiative determined?
What patients and providers participate? How are they selected?

7. Customer base

number of users   _____
number of units/devices   _____
number of uses per time unit   _____
number of units in use now   _____
total number of units needed   _____

8. Market penetration
Uses of the technology/total incidence or number of uses

one year ago   _____
today   _____
one year from now (estimated)   _____

MATURITY

9. Technology Sources
list all that apply

Non-developmental item

❑ commercial off-the-shelf (COTS)

❑ government of-the-shelf (GOTS)

Developmental

❑ enhanced (customized) GOTS/COTS

❑ custom ("one-off," finished product)

❑ prototype (as a phase of development)

10. Integration with existing IM/IS infrastructure

❑ Yes

   ❑ full functionality

   ❑ demonstration mode only

❑ No

11. Anticipated time to mainstream acceptance and use

❑ Today (1997-2000)

❑ Transition (2000-2007)

❑ Force XXI (2007-2017)

❑ Army After Next (2017-2025)

❑ Army of the future (beyond 2025)

12. Barriers to entry

❑ development cost

❑ unit cost

❑ complexity

❑ physician/provider resistance

❑ patient resistance

❑ immature technology

❑ competing product or practice

13. FDA regulatory status

❑ None

❑ Under review

   ❑ 501k

   ❑ PMA

❑ Approved

PERFORMANCE

14. Describe the system components
model, peripherals, software version, weight/cube, power requirements, MILSPEC, etc.

Hardware

Software

Networking

Telecommunications

15. What data fields are
acquired:
transmitted:
archived:

16. How is data transmitted?

17. What are the bandwidth requirements?

18. What data standards are currently used?
(e.g., HL7, DICOM, TCP/IP, H32x)

19. What is the system load ?
(frequency of use, time per use)

20. How is integration with existing IM/IS resources achieved?

21. Is the system used in a clinical evaluation process?

22. Is the process approved by a duly constituted institutional review board?

RELIABILITY

23. What is the reliability level?
number of times use is successful/number of times use attempted

24. What are the service requirements?
routine:
unscheduled:

25. What personnel are allocated to
system administration:
technical service support:

26. In what environments is the system designed to operate?

27. In what field environments has the system been tested?

28. What training is required before using the system?

APPENDIX H

REL TRAVEL/MEETING SUMMARY

REL ACTIVITY SUMMARY (FY 98)

DAY	DATE	LOCATION	PERSON	POSITION	PURPOSE
Oct-97					
Monday	20-Oct-98	CHES	COL Hassell, Baker, etc.	REL COTR	Contr. awarded, initial meeting, IPR
Tuesday	28-Oct-98	USAMRMC	BG Russ Zajtchuk	CMDR, USAMRMC	Competitive Market Analysis
		USAMRMC	COL Dean Calcagni	Chief of Staff	Competitive Market Analysis
		USAMRMC	Dr. Robert Foster	Chief Scientist	Competitive Market Analysis
		USAMRMC	Lloyd L. Salisbury	Bioengineer, Product Mgr.	Competitive Market Analysis
		USAMRMC	Conrad Clyburn	Chief, Prgm Intgr & Planning	Competitive Market Analysis
Nov-97					
Monday	10-Nov-98	CHPPM	Dr. Robert Ryczak	Integration	Competitive Market Analysis
		DARPA	Dr. Larry Dubois	DSO Office Director	Competitive Market Analysis
		DARPA	Dr. Jane Alexander	DSO Dept Director	Competitive Market Analysis
	10-Nov-98	USUHS	Dr. F. Edward Hebert	School of medicine	Competitive Market Analysis
		USUHS	Dr. Norm M. Rich	Chair, Dept of Surgery	Competitive Market Analysis
			Dr. Chris Kaufmann	Telesurgery	Competitive Market Analysis
Friday	14-Nov-98	CHES	TIGOSC Meeting	NA	First TIGOSC meeting
		USUHS	LTCOL Chris Kaufmann	Telesurgery POC	Competitive Market Analysis
Dec-97					
Thursday	04-Dec-97	MEDCOM-Skyline	COL Baker, Hassell, etc.	REL COTR	REL IPR
		MEDCOM-Skyline	COL David L. Shroeder	CIO	Competitive Market Analysis
		MEDCOM-Skyline	COL Sid Sado	Army Rep to TPO	Competitive Market Analysis
Friday	05-Dec-97	VA	R. David Albinson	CIO	Competitive Market Analysis
		VA	Dr. Robert M. Kolodner	Associate CIO	Competitive Market Analysis
Thursday	18-Dec-97	Pentagon	TIGOSC Update via VTC	NA	TIGOSC update

DAY	DATE	LOCATION	PERSON	POSITION	PURPOSE
Jan-98					
Thursday	22-Jan-98	BAMC	Mr. Bobby Dean	VTC Telemedicine(PRC)	Site Visit
Friday	23-Jan-98	DACH	Mr. Everett E. Pitt Jr.	DACH Telecom Chief	Site Visit
Monday	09-Feb-98	CHES	COL Harrison Hassell	REL COTR	REL Update
		CHES	MAJ Paul Rivera	NA	REL Update
		BAMC	LTCOL Daryl Zeigler		Site Visit
		BAMC	LTC Thomas E. Wittman	BAMC CIO	Site Visit
		BAMC	Ms. Vicky Hamlin	BAMC Info Management	Site Visit
		BAMC	Mr. Bobby Dean	VTC Telemedicine(PRC)	Site Visit
		BAMC	Ms. Evelyn Vergara	BAMC Internal Auditor	Site Visit
Tuesday	10-Feb-98	DACH	Mr. Everett E. Pitt Jr.	DACH Telecom Chief	Site Visit
		DACH	CPT L. Albert Villarin Jr.	Telemedicine Coordinator	Site Visit
		DACH		Chief Psychiatrist	Site Visit
		DACH		Pathologist	Site Visit
Thursday	26-Feb-98	DACH	Col Alan Love (Ret.)	N/A	DACH Background info
		DACH	Col Kenneth Farmer	DACH Commander	Site Visit
		DACH	MAJ Robert Newhouse	DACH CIO	Site Visit
		DACH	Mr. Everett E. Pitt Jr.	DACH Telecom Chief	Site Visit
Friday	27-Feb-98	BAMC	Mr. Bobby Dean	VTC Telemedicine(PRC)	Follow-up
		NOD	Mr. Kenneth Trawick	Comm Tech (SAIC)	Site Visit
		NOD	Ms. Lisa M. Galneau	Dep. District Manager (SAIC)	Site Visit
		NOD	Mr. Jay Ellis	Systems Engineer (SAIC)	Site Visit
		NOD	Mr. Dwaine Brown	USAMISSA/HCS	Site Visit
		BAMC	BG Timboe	BAMC Commander	Site Visit
Saturday	28-Feb-98	AMEDD C&S	MG Peake	AMEDD C&S Commander	REL Discussions

DAY	DATE	LOCATION	PERSON	POSITION	PURPOSE
Mar-98					
Monday	02-Mar-98	POLK	1LT Tom Baker	Bayne-Jones CIO	Site Visit
			SSGT Robert Porter	Bayne-Jones NCO	Site Visit
			COL C. William Fox Jr.	Bayne-Jones Hospital Command	Site Visit
Wednesday	11-Mar-98	Pentagon	BG John S. Parker	DCS/ASG	Competitive Market Analysis
Thursday	12-Mar-98	Pentagon	Ms. Ann Giese	OSD (HA), Health Services Op	Competitive Market Analysis
		MEDCOM	REL IPR	NA	REL IPR
Tuesday	24-Mar-98	Walter Reed AMC	Dr. Edward Gomez	COL, MC	Competitive Market Analysis
Friday	29-Mar-98	AMEDD C&S	TIGOSC	NA	TICOSC
Monday	30-Mar-98	CHPPM	Dr. Robert Ryczak	Integration	Competitive Market Analysis
		CHPPM	BG Patrick D. Sculley	CHPPM Commander	Competitive Market Analysis
		CHPPM	Dr. Edward S. Evans	Program Manager	Competitive Market Analysis
		CHPPM	Dr. Bruce H. Jones	Epidemiology & Dis Surv Dir.	Competitive Market Analysis
Tuesday	31-Mar-98	TPO	CMDR Forrest Faison	TPO	Competitive Market Analysis
		TPO	Harry M. Young	Contr. Northup Grumman	Competitive Market Analysis
Monday	06-Apr-98	ORNL	Jay Cook	Director, Center for Mfr Tech	Competitive Market Analysis
		ORNL	Dr. Clay E. Easterly	Senior Scientist	Competitive Market Analysis
		ORNL	Dr. G. Wayne Morrison	Program Mgr	Competitive Market Analysis
		ORNL	Dr. Stephen F. Smith	RF & Microwave Systems	Competitive Market Analysis
		ORNL	Dr. R. J. Warmack	Group Leader	Competitive Market Analysis

BEFORE FY 98

DAY	DATE	LOCATION	PERSON	POSITION	PURPOSE
Tuesday	14-Jan-97	Walter Reed AMC	Dr. Renata J.M. Engler	Chief, Clinical & Lab Immunolog	Competitive Market Analysis
Tuesday	14-Jan-97	USA Health Fac. Planning	Mary Frances Morgan	Health Facility Planner	Competitive Market Analysis
Tuesday	06-Feb-97	Walter Reed AMC	MG Leslie M. Burger	Commander	Competitive Market Analysis
Friday	14-Feb-97	Portsmouth NMC	RADM William R. Rowley	Commander	Competitive Market Analysis
Tuesday	04-Mar-97	Coleman Federal	Gordon R. Sullivan	President	Competitive Market Analysis
Tuesday	20-Mar-97	Council on Competitiveness	Susanne P. Tichenor	Vice President	Competitive Market Analysis
Tuesday	08-Jul-97	Harvard University	Dr. Joseph D. Bain	Professor	Competitive Market Analysis
		Harvard University	Dr. K. Cecil	Chair, Dept of Environ Health	Competitive Market Analysis
		Harvard University	Dr. Phillip Drinker	Director, Physiology Program	Competitive Market Analysis

APPENDIX I

TRICARE SOUTHWEST BROCHURE

brochure_hdr.gif (2671 bytes)

"Moving Region 6 toward a successful transition to the 21st Century is a top priority."

Region 6 covers about 1.1 million Department of Defense (DoD) beneficiaries and oversees 19 military medical treatment facilities. These clinics and hospitals number 14 Air Force, 4 Army and 1 Navy. The region also contains Uniformed Services Treatment Facilities and several Veteran's Administration facilities.

The diverse facilities in Region 6 include the largest Air Force medical center, Wilford Hall Medical Center; the newest, Brooke Army Medical Center; and the smallest Air Force clinic, the 70th Medical Squadron at Brooks AFB.

Moving Region 6 toward a successful transition to the 21st Century is a top priority. The TRICARE Southwest Lead Agent staff has developed several innovative programs incorporating the Region 6 vision. Among these DoD prototypes are the **Medical Outreach Managed Care** program; **TRICARE Southwest: A National Telemedicine Network; and the TRICARE Southwest Managed Care University.**

The Medical Outreach Managed Care program is a demonstration project designed to evaluate the concept of using operational support aircraft, such as a C-21 Learjet, to transport medical teams to underserved clinics and hospitals within the region. Medical Outreach is not a new concept; in its simplest form it is an example of a "1990s house call," taking the provider to the patient rather than requiring the patient to come to the provider.

Several of the 19 military bases and posts in Region 6 are in large metropolitan areas like San Antonio, while others are in sparsely populated areas like Del Rio, Texas or Altus, Oklahoma. Because some of these installations have large medical centers and others have small clinics, providing the maximum range of care at every facility within the region is a challenge. The solution lies in providing an efficient alternative means of specialty care delivery to populations with limited specialty availability. The Medical Outreach Managed Care program offers that advantage: the primary goal is a more equitable, cost-effective health care benefit throughout the region.

For many years the military has sent its health care providers to other locations to support smaller facilities in out -of-area locations, which has worked well. However, travel time translates to lost provider hours and lost appointments. An alternative has been to ask the patient to travel to the provider. This alternative also works well. The cost? Many hours of lost duty time, lost wages, time away from the family and additional travel expenses. These traditional methods, though status quo for many years, are really win/lose opportunities which present dilemmas for either the patient or the provider.

This Medical Outreach Managed Care initiative has already proven to be successful! Between December, 1994 and April, 1996, the C-21 crews flew 108 missions in Region 6 and providers saw **5,919** patients. By taking the providers to the patients, **7,189** active duty days were saved. Total costs avoided in this time period were over **$377,285.**

Another version of managed care outreach is the Thursday Hospital program. The Thursday Hospital concept takes ambulatory surgery teams to downsized hospitals in the region to perform procedures on site. The teams rotate between remote facilities each day of the week. To date, Dyess AFB, Laughlin AFB and Corpus Christi NAS are participating in the Thursday Hospital program and have avoided over **$637,850** in costs.

The second major initiative is the TRICARE Southwest National Telemedicine Network. The term "telemedicine" is an umbrella term which includes care provided through telecommunications technology in the form of systems such as teleconsulting, teleradiology and telepathology. This video-teleconferencing-based network for Region 6 supports the development and delivery of health care over long distances, linking military bases in a regional communications infrastructure.

The benefits of the new telemedicine project are numerous. First, telemedicine will improve beneficiary access to referrals. Second, both beneficiary and provider satisfaction will increase due to less traveling for the patient to a specialist or the specialist to a remote site. Additionally, the family practice physician will maintain control of the patient and thus gain knowledge of more complex medical problems and improve continuity of care. A third benefit is to prepare providers for support of deployed forces via teleconsulting. Fourth, the program will be cost-effective. Finally, the telemedicine program will integrate the regional referral process and facilitate cross-service referrals.

Telemedicine includes an interactive video system integrated with biomedical telemetry. It allows a physician at a specialty medical complex or teaching hospital to examine and treat patients at multiple satellite locations such as rural hospitals and clinics. A number of diagnostic devices are integrated into the video system based on the requirements of the remote medical facility.

The remotely controlled examination camera has a powerful zoom-focus capability which allows a dermatologist to examine small details of a patient's skin. An electronic stethoscope, in conjunction with real-time digital transmission of an EKG and echocardiogram, permits a cardiologist to do a complete cardiology examination. Specific camera adapters and resolution capabilities enhanced by remote-controlled optics provide an ophthalmologist a clear view of the retina of a patient at the referring site. A pathologist using the telemicroscopic adapter can examine a frozen section or bone marrow slide. A document camera provided with the newest teleradiology system will also allow consulting physicians to review x-ray films.

The TRICARE Southwest National Telemedicine Network was one of the first DoD telemedicine projects to be approved by the DoD MilitaryHealth Services System (MHSS) Proponent Committee. Since a regional telemedicine network could potentially avoid over $1 million in costs annually from reduction in travel and CHAMPUS costs throughout the remote locations in Region 6, a real potential exists for a payback of less than three years for the telemedicine project.

The Region 6 Lead Agent staff is also spearheading another DoD prototype, "TRICARE Southwest Managed Care University." This video teleconferencing network (VTCN), or "virtual" university, provides continuing executive skills education for MTFs in the region via VTCN. The curriculum is based on current industry practices and ongoing developments in knowledge and skills required for success in an environment which is rapidly changing from the traditional military medicine paradigm to a managed care environment. The curriculum is also based on the unique requirements of the region's military installations and the TRICARE program.

Region 6 relies heavily on course material already available or under development from existing Air Force, Navy, Army and Uniformed Services University of the Health Sciences sources. Additional course material has been provided by sources in industry and academia, such as the U.S. Army-Baylor Graduate Program in Health Care Administration, Ft. Sam Houston, San Antonio, Texas; and the School of Health Care Sciences, Sheppard AFB, Wichita Falls, Texas.

The executive skills program has established VTCN capability at the Lead Agent office and all 19 regional clinics and hospitals, as well as communication links to the principal curriculum developers. Course material will be presented in a video seminar format. An estimated 30 course hours per year will be provided to these 20 locations each year.

"The Region 6 Lead Agent staff is committed...to TRICARE's success..."

Region 6 is not only involved in many innovative programs. The region also strives to blur the lines between the services, as well as optimize resources, by providing specialists and support staff from WHMC and BAMC to other Region 6 facilities such as Ft Hood, Ft Polk, and the Naval Hospital, Corpus Christi .

As the Air Force, Army and Navy work together in Region 6 toward a successful transition to TRICARE, the Lead Agent is utilizing tools such as the **Health Enrollment Assessment Review (HEAR), the Health Care Information Line (HCIL), a Mail-Order Pharmacy benefit** and the **Health Plan Employer Data and Information Set (HEDIS).**

During enrollment to TRICARE Prime, each enrollee over 17 years old will be asked to complete a HEAR survey. The HEAR is designed to identify disease risk factors, chronic disease history, currency of preventive service screenings and prior utilization patterns for the enrollee. The survey's primary purpose is to identify the health status of the individual upon enrollment. This tool will help providers and beneficiaries shift from an individual episodic health care model to a population-based, prevention-oriented model of health care.

Several reports will be generated from the HEAR data. The patient will receive a concise report which addresses his/her currency for age-appropriate preventive screening tests, modifiable health risk factors and chronic disease history.

The primary care manager (PCM) will receive an individual patient report which addresses similar information as the patient report, but also addresses such areas as prior utilization patterns, prescription medication use and a prediction of the level of care needed for the patient.

Additionally, provider panel reports will be generated which address characteristics of the patient population assigned to that provider. Similar reports can be generated for provider groups, MTFs, catchment areas, etc. Ad hoc reports can be generated which can identify the patients' currency of clinical preventive services, health risk factors, chronic diseases and who are potential candidates for utilization/case management at the regional, MTF and PCM levels.

Beneficiaries in Region 6 also have access to the HCIL-a 24-hour phone service which provides answers to hundreds of health questions. By calling a toll-free number, beneficiaries may either speak to a Personal Health Advisor (a registered nurse) for help in evaluating symptoms for themselves or a

family member, or listen to over 400 recorded messages about a variety of health topics through the Audio Health Library.

The Mail-Order Pharmacy benefit is included in the Region 6 TRICARE contract as a convenience for CHAMPUS-eligible beneficiaries. The Mail-Order option offers a way to order maintenance medications at a lower co-pay than at a TRICARE network pharmacy. The Mail-Order Pharmacy benefit is also available to Medicare-eligible beneficiaries in Base Realignment and Closure (BRAC) sites.

Since Region 6 will be in competition with and compared to other managed care organizations, HEDIS provides a common basis by which to make those comparisons. Generally speaking, the major players in the managed care industry use the HEDIS as the basis for those comparisons.
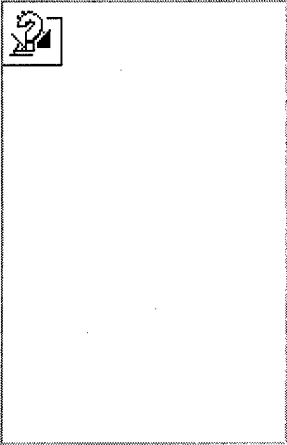
The HEDIS performance measures are the result of a collaborative effort between The HMO Group, the National Committee on Quality Assurance and the Performance Assessment Committee. The HEDIS will cover 65 individual measures in five major areas of evaluation: Quality, Access and Patient Satisfaction, Membership and Utilization, Finance, and Descriptive Information on Health Plan Management.

The Region 6 Lead Agent staff is committed not only to TRICARE's success, but also to the region's success in a rapidly changing health care environment. The staff continues to look at other regions' lessons learned, while analyzing and optimizing the characteristics of our beneficiary population.

The combination of a hand-picked tri-service team, excellent information flow and customer-oriented programs is win-win-win for DoD, Region 6, and most important, for the beneficiaries.

HOME   SEARCH

Contact Webmaster

Revised:04/21/1998

APPENDIX J

TRICARE SOUTHRWEST TELEMEDICINE ACTIVITIES

● **Go to the Federal Telemedicine Gateway Menu**

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TRICARE Southwest: Abstract

A quick link to the Comprehensive Summary or Inventory Homepage

TRICARE Southwest is located at 7800 IH-10 West Suite 400, San Antonio, TX 78230-4750. The point of contact for telemedicine is Capt. Linda Eaton at (210) 678-3217.

To finance its work in telemedicine, TRICARE Southwest has received $4,500,000 from the Department of Defense (DoD).

TRICARE Southwest telemedicine activities involve 34 facilities. Clinical services provided include nursing, specialties, general medicine/primary care, and general surgery. Specialty services provided include cardiology, dermatology, emergency medicine, endocrinology, gastroenterology, geriatrics, gynecology, hematology, infectious disease, nephrology, neurology, obstetrics, oncology, ophthalmology, orthopedics, otolaryngology, pathology, pediatrics, physical medicine, primary care, pulmonology, radiology, rheumatology, and urology.

● **Go to the Federal Telemedicine Gateway Menu**

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Last updated: 6/23/97

Go to the Federal Telemedicine Gateway Menu

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TRICARE Southwest: Comprehensive Summary

A quick link to the Abstract or the Inventory Homepage

Primary Organization
Participating Organizations
Networks
Projects
Facilities

Primary Organization Information

Return to top of page

Primary organization description:
 A local-government organization
Address:
 DoD Region VI Lead Agent Office
 7800 IH-10 West Suite 400
 San Antonio, TX 78230-4750
Point of contact:
 Capt. Linda Eaton
 Phone: (210) 678-3217
 Fax: (210) 678-3222
 E-mail: Not available

Participating Organizations

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 Wilford Hall Medical Center
 Brooke AMC
 Randolph Clinic
 Kelly Clinic
 Brooks Clinic
 Corpus Cristi NAS Hospital
 Branch Clinic Ingleside
 Branch Clinic Kingsville
 Laughlin Hospital
 Goodfellow Clinic
 Darnall Army Community Hospital
 Dyess Hospital

Reese Clinic
Sheppard Hospital
School of Health Care Sciences
Reynolds Army Community Hospital
Altus Hospital
Tinker Hospital
Vance Clinic
Little Rock Hospital
Barksdale Hospital
Bayne-Jones Hospital

Networks

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For this initiative, the sole network is equivalent to the project. Therefore, the network information can be found in the "Projects section of this summary.

Projects

Return to top of page

●Region VI Telemedicine Pilot Project

PROJECT FUNDING SOURCES

Department of Defense (DoD)

Point of contact:
    None
    Phone: Not available
    Fax: Not available
    E-mail: Not available
Funding award:
    Start date: 01-Oct-95
    End date: 30-Sep-96
    Total award: $2,500,000

PROJECT OBJECTIVES

Rank of objectives (in order of importance with 1 being most important and 9 being least important):
    None reported
Approach to accomplish these objectives:
    Not reported
Total target population in the service area:
    Not reported

PROJECT FUNCTIONS

PROJECT COSTS ASSOCIATED WITH TELEMEDICINE (ACCURACY UNKNOWN)

A quick link to Grant Awards by Agency

> Not reported

SATISFACTION AND DATA COLLECTED

Information collected regarding satisfaction:
> Not reported

REPORTING AND OTHER DATA ISSUES

Uses of evaluation data:
> Not reported if statistical analyses will be performed on evaluation data.
> Not reported if evaluation data is stored electronically.
> Not reported if evaluation data is available to external researchers.

PROJECT EXPERIENCE

Unique qualities:
> Not reported
Lessons learned:
> Not reported
Objectives and how they are being met (in order of importance with 1 being most important and 9 being least important):
> Assessment of objectives have not been provided

●Region VI Telepathology Network

PROJECT FUNDING SOURCES

Department of Defense (DoD)

Point of contact: None
Funding award:
> Start date: 01-Apr-96
> End date: 01-Apr-96
> Total award: $500,000

PROJECT OBJECTIVES

Rank of objectives (in order of importance with 1 being most important and 9 being least important):
> None reported
Approach to accomplish these objectives:
> Not reported
Total target population in the service area:
> Not reported

PROJECT FUNCTIONS

PROJECT COSTS ASSOCIATED WITH TELEMEDICINE (ACCURACY UNKNOWN)

A quick link to Grant Awards by Agency

 Not reported

SATISFACTION AND DATA COLLECTED

Information collected regarding satisfaction:
 Not reported

REPORTING AND OTHER DATA ISSUES

Uses of evaluation data:
 Not reported if statistical analyses will be performed on evaluation data.
 Not reported if evaluation data is stored electronically.
 Not reported if evaluation data is available to external researchers.

PROJECT EXPERIENCE

Unique qualities:
 Not reported
Lessons learned:
 Not reported
Objectives and how they are being met (in order of importance with 1 being most important and 9 being least important):
 Assessment of objectives have not been provided

●TRICARE Southwest Managed Care University

PROJECT FUNDING SOURCES

Department of Defense (DoD)

Point of contact:
 None
 Phone: Not available
 Fax: Not available
 E-mail: Not available
Funding award:
 Start date: 01-Oct-95
 End date: 30-Sep-96
 Total award: $1,500,000

PROJECT OBJECTIVES

Rank of objectives (in order of importance with 1 being most important and 9 being least important):
    None reported
Approach to accomplish these objectives:
    Not reported
Total target population in the service area:
    Not reported

PROJECT FUNCTIONS

PROJECT COSTS ASSOCIATED WITH TELEMEDICINE (ACCURACY UNKNOWN)

A quick link to Grant Awards by Agency

   Not reported

SATISFACTION AND DATA COLLECTED

Information collected regarding satisfaction:
    Not reported

REPORTING AND OTHER DATA ISSUES

Uses of evaluation data:
    Not reported if statistical analyses will be performed on evaluation data.
    Not reported if evaluation data is stored electronically.
    Not reported if evaluation data is available to external researchers.

PROJECT EXPERIENCE

Unique qualities:
    Not reported
Lessons learned:
     Not reported
Objectives and how they are being met (in order of importance with 1 being most important and 9 being least important):
    Assessment of objectives have not been provided

Facilities Providing Telemedicine Under the Direction of TRICARE Southwest

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●TRICARE Southwest- Dod Lead Agent Office

(Project: Region VI Telemedicine Pilot Project)

(Project: Region VI Telepathology Network)

(Project: TRICARE Southwest Managed Care University)

Specific information regarding this facility has not been reported.

●Wilford Hall Medical Center

(Project: Region VI Telemedicine Pilot Project)

(Project: Region VI Telepathology Network)

(Project: TRICARE Southwest Managed Care University)

Facility description:
    Acute Care Hospital - Outpatient
    Address (described as urban):
        LACKLAND AFB
        San Antonio, TX 78236
    Patient volume:
        Number of (hospital) beds: 747
        Number of clinic visits: Not reported or applicable
    How consults are scheduled:
        Regularly scheduled clinics
    Facility availability:
        Regularly available on specific days or times

COSTS ASSOCIATED WITH TELEMEDICINE (ACCURACY UNKNOWN)

A quick link to Grant Awards by Agency

    Not reported

PARTICIPATING CARE PROVIDERS

Physicians
Physician Assistants

TECHNOLOGY AND COMMUNICATIONS USED

Bandwidth capacity:
    Full T1 or DS-1
Transmission medium:
    Lan - Ethernet
    WAN - Point to Point, Dedicated T1
Real-time data/image transfer:
    Full motion interactive video
Stored and forwarded data/image transfer:

Still images for later review
Video clips for later review
Audio clips for later review
Text e-mail
Network architecture:
Client-server
Computer operating system (OS):
DOS/Windows
Types of equipment used:
Multi-media

CLINICAL SERVICES AND SPECIALTIES

Consultation reporting period:1st quarter of 1996
Clinical services:
Specialty
General medicine/primary care
General surgery
Summary of clinical specialties:
Dermatology
Orthopedics
Obstetrics
Gynecology
Pediatrics
Neurology
Cardioliogy
ENT
Ophthalmology

TELEMEDICINE PERIPHERALS USED

Document camera
Electronic stethoscope
ENT scope
Microscope
Ophthalmoscope
Computed Radiography

●Brooke AMC

(Project: Region VI Telemedicine Pilot Project)

(Project: Region VI Telepathology Network)

(Project: TRICARE Southwest Managed Care University)

Facility description:
Acute Care Hospital - Outpatient
Acute Care Hospital - Inpatient
Acute Care Hospital - Outpatient
Community Health Center
Dental

Physician Office
Address (described as urban):
    FORT SAM HOUSTON
    San Antonio, TX 78234-6200
Patient volume:
    Number of (hospital) beds: 458
    Number of clinic visits: Not reported or applicable
How consults are scheduled:
    As requested (ad hoc)
    Regularly scheduled clinics
    Emergency
Facility availability:
    Regularly available on specific days or times

COSTS ASSOCIATED WITH TELEMEDICINE (ACCURACY UNKNOWN)

A quick link to Grant Awards by Agency

    Not reported

PARTICIPATING CARE PROVIDERS

Physicians
Physician Assistants
Certified Nurse Mid-wives
Nurse Practitoners
Nurses
Clinical Nurse Specialists
Physical Therapists
Occupational Therapists
Speech Therapists

TECHNOLOGY AND COMMUNICATIONS USED

Bandwidth capacity:
    Full T1 or DS-1
    Dedicated fiberoptic intrafacility
Transmission medium:
    Lan - Ethernet
    WAN - Point to Point, Dedicated T1
Real-time data/image transfer:
    Full motion interactive video
    Still images with 2-way audio
    Video clips with 2-way audio
Stored and forwarded data/image transfer:
    Video clips for later review
    Audio clips for later review
    Text e-mail
    Still images for later review
Network architecture:
    Client-server
Computer operating system (OS):
    DOS/Windows
    Macintosh

Types of equipment used:
- **Multi-media**
- **Dedicated radiology workstation**

CLINICAL SERVICES AND SPECIALTIES

Consultation reporting period:2nd quarter of 1996
Clinical services:
- **Nursing**
- **Specialty**
- **General medicine/primary care**
- **General surgery**

Summary of clinical specialties:

TELEMEDICINE PERIPHERALS USED

Document camera
Electronic stethoscope
ENT scope
Microscope
Ophthalmoscope
Computed Radiography

●Randolph Clinic

(Project: TRICARE Southwest Managed Care University)

Address:
- **221 3rd Street West**
- **Randolph AFB, TX 78150**

Patient volume:
- **Number of (hospital) beds: Not reported or applicable**
- **Number of clinic visits: Not reported or applicable**

How consults are scheduled:
- **Not reported**

Facility availability:
- **Not reported**

COSTS ASSOCIATED WITH TELEMEDICINE (ACCURACY UNKNOWN)

A quick link to Grant Awards by Agency

Not reported

TECHNOLOGY AND COMMUNICATIONS USED

Technology and Communications not reported.

CLINICAL SERVICES AND SPECIALTIES

None reported

TELEMEDICINE PERIPHERALS USED

Not reported

●Kelly Clinic

(Project: TRICARE Southwest Managed Care University)

Address:
   204 Wagner Drive, Bldg. 1740
   Kelly AFB, TX 78241
Patient volume:
   Number of (hospital) beds: Not reported or applicable
   Number of clinic visits: Not reported or applicable
How consults are scheduled:
   Not reported
Facility availability:
   Not reported

COSTS ASSOCIATED WITH TELEMEDICINE (ACCURACY UNKNOWN)

A quick link to Grant Awards by Agency

Not reported

TECHNOLOGY AND COMMUNICATIONS USED

Technology and Communications not reported.

CLINICAL SERVICES AND SPECIALTIES

None reported

TELEMEDICINE PERIPHERALS USED

Not reported

●Brooks Clinic

(Project: TRICARE Southwest Managed Care University)

Address:
   8005 Lindbergh Drive
   Brooks AFB, TX 78235
Patient volume:
   Number of (hospital) beds: Not reported or applicable
   Number of clinic visits: Not reported or applicable

How consults are scheduled:
Not reported
Facility availability:
Not reported

COSTS ASSOCIATED WITH TELEMEDICINE (ACCURACY UNKNOWN)

A quick link to Grant Awards by Agency

Not reported

TECHNOLOGY AND COMMUNICATIONS USED

Technology and Communications not reported.

CLINICAL SERVICES AND SPECIALTIES

None reported

TELEMEDICINE PERIPHERALS USED

Not reported.

●Corpus Christi NAS Hospital

(Project: Region VI Telemedicine Pilot Project)

(Project: Region VI Telepathology Network)

(Project: TRICARE Southwest Managed Care University)

Address:
Naval Hospital
Corpus Christi, TX 78419
Patient volume:
Number of (hospital) beds: Not reported or applicable
Number of clinic visits: Not reported or applicable
How consults are scheduled:
Not reported
Facility availability:
Not reported

COSTS ASSOCIATED WITH TELEMEDICINE (ACCURACY UNKNOWN)

A quick link to Grant Awards by Agency

Not reported

TECHNOLOGY AND COMMUNICATIONS USED

Bandwidth capacity:
    Full T1 or DS-1
Transmission medium:
    Lan - Ethernet
    WAN - Point to Point, Dedicated T1
Real-time data/image transfer:
    Full motion interactive video
Stored and forwarded data/image transfer:
    Still images for later review
    Video clips for later review
    Audio clips for later review
    Text e-mail
Network architecture:
    Client-server
Computer operating system (OS):
    DOS/Windows
Types of equipment used:
    Multi-media

CLINICAL SERVICES AND SPECIALTIES

Primary Care Services

TELEMEDICINE PERIPHERALS USED

Document Camera
Electronic Stethoscope
ENT Scope
Ophthalmascope
Microscope
Slit Lamp

●Branch Clinic Ingleside

(Project: TRICARE Southwest Managed Care University)

Address:
    7500 EAST HELLMAN AVENUE
    ROSEMEAD, CA 91770
Patient volume:
    Number of (hospital) beds: 126
    Number of clinic visits: Not reported or applicable
How consults are scheduled:
    Not reported
Facility availability:
    Not reported

COSTS ASSOCIATED WITH TELEMEDICINE (ACCURACY UNKNOWN)

A quick link to Grant Awards by Agency

Not reported

TECHNOLOGY AND COMMUNICATIONS USED

Technology and Communications not reported.

CLINICAL SERVICES AND SPECIALTIES

None reported

TELEMEDICINE PERIPHERALS USED

Not reported

●Branch Clinic Kingsville

(Project: TRICARE Southwest Managed Care University)

Address:
Naval Air Station
Kingsville, TX 78363
Patient volume:
Number of (hospital) beds: Not reported or applicable
Number of clinic visits: Not reported or applicable
How consults are scheduled:
Not reported
Facility availability:
Not reported

COSTS ASSOCIATED WITH TELEMEDICINE (ACCURACY UNKNOWN)

A quick link to Grant Awards by Agency

Not reported

TECHNOLOGY AND COMMUNICATIONS USED

Technology and Communications not reported.

CLINICAL SERVICES AND SPECIALTIES

None reported

TELEMEDICINE PERIPHERALS USED

Not reported

●Laughlin Hospital

(Project: Region VI Telemedicine Pilot Project)

(Project: TRICARE Southwest Managed Care University)

Address:
    590 Mitchell Boulevard
    Laughlin AFB, TX 78843
Patient volume:
    Number of (hospital) beds: 7
    Number of clinic visits: Not reported or applicable
How consults are scheduled:
    Not reported
Facility availability:
    Not reported

COSTS ASSOCIATED WITH TELEMEDICINE (ACCURACY UNKNOWN)

A quick link to Grant Awards by Agency

    Not reported

TECHNOLOGY AND COMMUNICATIONS USED

Bandwidth capacity:
    Full T1 or DS-1
Transmission medium:
    Lan - Ethernet
    WAN - Point to Point, Dedicated T1
Real-time data/image transfer:
    Full motion interactive video
Stored and forwarded data/image transfer:
    Still images for later review
    Video clips for later review
    Audio clips for later review
    Text e-mail
Network architecture:
    Client-server
Computer operating system (OS):
    DOS/Windows
Types of equipment used:
    Multi-media

CLINICAL SERVICES AND SPECIALTIES

Primary Care Services

TELEMEDICINE PERIPHERALS USED

Document Camera
Electronic Stethoscope

ENT Scope
Ophthalmascope
Microscope
Computed Radiography

●Goodfellow Clinic

(Project: Region VI Telemedicine Pilot Project)

(Project: TRICARE Southwest Managed Care University)

Address:
271 Fort Richardson Avenue
Goodfellow AFB, TX 76908
Patient volume:
Number of (hospital) beds: Not reported or applicable
Number of clinic visits: Not reported or applicable
How consults are scheduled:
Not reported
Facility availability:
Not reported

TECHNOLOGY AND COMMUNICATIONS USED

Bandwidth capacity:
Full T1 or DS-1
Transmission medium:
Lan - Ethernet
WAN - Point to Point, Dedicated T1
Real-time data/image transfer:
Full motion interactive video
Stored and forwarded data/image transfer:
Still images for later review
Video clips for later review
Audio clips for later review
Text e-mail
Network architecture:
Client-server
Computer operating system (OS):
DOS/Windows
Types of equipment used:
Multi-media

CLINICAL SERVICES AND SPECIALTIES

Primary Care Services

TELEMEDICINE PERIPHERALS USED

Document Camera
Electronic Stethoscope
ENT Scope

Ophthalmascope
Microscope
Computed Radiography

●Darnall Army Community Hospital (Ft. Hood)

(Project: Region VI Telemedicine Pilot Project)

(Project: Region VI Telepathology Network)

(Project: TRICARE Southwest Managed Care University)

Address:
Fort Hood
Fort Hood, TX 76544
Patient volume:
Number of (hospital) beds: 236
Number of clinic visits: Not reported or applicable
How consults are scheduled:
Not reported
Facility availability:
Not reported

COSTS ASSOCIATED WITH TELEMEDICINE (ACCURACY UNKNOWN)

A quick link to Grant Awards by Agency

Not reported

TECHNOLOGY AND COMMUNICATIONS USED

Bandwidth capacity:
Full T1 or DS-1
Transmission medium:
Lan - Ethernet
WAN - Point to Point, Dedicated T1
Real-time data/image transfer:
Full motion interactive video
Stored and forwarded data/image transfer:
Still images for later review
Video clips for later review
Audio clips for later review
Text e-mail
Network architecture:
Client-server
Computer operating system (OS):
DOS/Windows
Types of equipment used:
Multi-media

CLINICAL SERVICES AND SPECIALTIES

Consultation reporting period: 1st quarter of 1996
Clinical services:
    Specialty
    General medicine/primary care
    General surgery
Summary of clinical specialties:
    Dermatology
    Orthopedics
    Obstetrics
    Gynecology
    Neurology
    Cardioliogy
    Ophthalmology

TELEMEDICINE PERIPHERALS USED

Document camera
Electronic stethoscope
ENT scope
Microscope
Ophthalmoscope
Computed Radiography

●Dyess Hospital

(Project: Region VI Telemedicine Pilot Project)

(Project: TRICARE Southwest Managed Care University)

Address:
    697 Hospital Road
    Dyess AFB, TX 79563
Patient volume:
    Number of (hospital) beds: Not reported or applicable
    Number of clinic visits: Not reported or applicable
How consults are scheduled:
    Not reported
Facility availability:
    Not reported

TECHNOLOGY AND COMMUNICATIONS USED

Bandwidth capacity:
    Full T1 or DS-1
Transmission medium:
    Lan - Ethernet
    WAN - Point to Point, Dedicated T1
Real-time data/image transfer:
    Full motion interactive video
Stored and forwarded data/image transfer:
    Still images for later review

Video clips for later review
Audio clips for later review
Text e-mail
Network architecture:
Client-server
Computer operating system (OS):
DOS/Windows
Types of equipment used:
Multi-media

CLINICAL SERVICES AND SPECIALTIES

Primary Care Services

TELEMEDICINE PERIPHERALS USED

Document Camera
Electronic Stethoscope
ENT Scope
Ophthalmascope
Microscope
Computed Radiography

●Reese Clinic (BRAC)

(Project: TRICARE Southwest Managed Care University)

Address:
250 13th Street
Reese AFB, TX 79489
Patient volume:
Number of (hospital) beds: Not reported or applicable
Number of clinic visits: Not reported or applicable
How consults are scheduled:
Not reported
Facility availability:
Not reported

COSTS ASSOCIATED WITH TELEMEDICINE (ACCURACY UNKNOWN)

A quick link to Grant Awards by Agency

Not reported

TECHNOLOGY AND COMMUNICATIONS USED

Technology and Communications not reported.

CLINICAL SERVICES AND SPECIALTIES

None reported

TELEMEDICINE PERIPHERALS USED

Not reported

●Sheppard Hospital

(Project: TRICARE Southwest Managed Care University)

Address:
    6501 North Charles Street
    Baltimore, MD 21204
Patient volume:
    Number of (hospital) beds: Not reported or applicable
    Number of clinic visits: Not reported or applicable
How consults are scheduled:
    Not reported
Facility availability:
    Not reported

COSTS ASSOCIATED WITH TELEMEDICINE (ACCURACY UNKNOWN)

A quick link to Grant Awards by Agency

Not reported

TECHNOLOGY AND COMMUNICATIONS USED

Technology and Communications not reported.

CLINICAL SERVICES AND SPECIALTIES

None reported

TELEMEDICINE PERIPHERALS USED

Not reported

●School of Health Care Sciences

(Project: TRICARE Southwest Managed Care University)

Address:
    Sheppard Air Force Base

Specific information regarding this facility has not been reported.

•Reynolds Army Community Hospital

(Project: Region VI Telepathology Network)

(Project: TRICARE Southwest Managed Care University)

Address:
      4700 Hartell Boulevard
      Fort Sill, OK 73503
Patient volume:
      Number of (hospital) beds: 106
      Number of clinic visits: Not reported or applicable
How consults are scheduled:
      Not reported
Facility availability:
      Not reported

COSTS ASSOCIATED WITH TELEMEDICINE (ACCURACY UNKNOWN)

A quick link to Grant Awards by Agency

      Not reported

TECHNOLOGY AND COMMUNICATIONS USED

Technology and Communications not reported.

CLINICAL SERVICES AND SPECIALTIES

None reported

TELEMEDICINE PERIPHERALS USED

Not reported

•Altus Hospital

(Project: TRICARE Southwest Managed Care University)

Address:
      Altus AFB
      Altus, OK 73525
Patient volume:
      Number of (hospital) beds: 28
      Number of clinic visits: Not reported or applicable
How consults are scheduled:
      Not reported
Facility availability:
      Not reported

COSTS ASSOCIATED WITH TELEMEDICINE (ACCURACY UNKNOWN)

A quick link to Grant Awards by Agency

Not reported

TECHNOLOGY AND COMMUNICATIONS USED

Technology and Communications not reported.

CLINICAL SERVICES AND SPECIALTIES

None reported

TELEMEDICINE PERIPHERALS USED

Not reported

●Tinker Hospital

(Project: TRICARE Southwest Managed Care University)

Address:
    5700 Arnold Street
    Tinker AFB, OK 73145
Patient volume:
    Number of (hospital) beds: 25
    Number of clinic visits: Not reported or applicable
How consults are scheduled:
    Not reported
Facility availability:
    Not reported

COSTS ASSOCIATED WITH TELEMEDICINE (ACCURACY UNKNOWN)

A quick link to Grant Awards by Agency

Not reported

TECHNOLOGY AND COMMUNICATIONS USED

Technology and Communications not reported.

CLINICAL SERVICES AND SPECIALTIES

None reported

TELEMEDICINE PERIPHERALS USED

Not reported

•Vance Clinic

(Project: TRICARE Southwest Managed Care University)

Address:
Complete address unavailable
Patient volume:
Number of (hospital) beds: Not reported or applicable
Number of clinic visits: Not reported or applicable
How consults are scheduled:
Not reported
Facility availability:
Not reported

COSTS ASSOCIATED WITH TELEMEDICINE (ACCURACY UNKNOWN)

A quick link to Grant Awards by Agency

Not reported

TECHNOLOGY AND COMMUNICATIONS USED

Technology and Communications not reported.

CLINICAL SERVICES AND SPECIALTIES

None reported

TELEMEDICINE PERIPHERALS USED

Digital Radiography

•Little Rock Hospital

(Project: TRICARE Southwest Managed Care University)

Address:
Little Rock AFB
Jacksonville, AR 72099
Patient volume:
Number of (hospital) beds: 24
Number of clinic visits: Not reported or applicable
How consults are scheduled:
Not reported
Facility availability:
Not reported

COSTS ASSOCIATED WITH TELEMEDICINE (ACCURACY UNKNOWN)

A quick link to Grant Awards by Agency

Not reported

TECHNOLOGY AND COMMUNICATIONS USED

Technology and Communications not reported.

CLINICAL SERVICES AND SPECIALTIES

None reported

TELEMEDICINE PERIPHERALS USED

Not reported

●Barksdale Hospital

(Project: TRICARE Southwest Managed Care University)

Address:
        Barksdale AFB
        Shreveport, LA 71110
Patient volume:
        Number of (hospital) beds: 25
        Number of clinic visits: Not reported or applicable
How consults are scheduled:
        Not reported
Facility availability:
        Not reported

COSTS ASSOCIATED WITH TELEMEDICINE (ACCURACY UNKNOWN)

A quick link to Grant Awards by Agency

Not reported

TECHNOLOGY AND COMMUNICATIONS USED

Technology and Communications not reported.

CLINICAL SERVICES AND SPECIALTIES

None reported

TELEMEDICINE PERIPHERALS USED

Not reported

●Bayne-Jones Army Community Hospital

(Project: Region VI Telemedicine Pilot Project)

(Project: Region VI Telepathology Network)

(Project: TRICARE Southwest Managed Care University)

Address:
    Fort Polk
    Fort Polk, LA 71459
Patient volume:
    Number of (hospital) beds: 81
    Number of clinic visits: Not reported or applicable
How consults are scheduled:
    Not reported
Facility availability:
    Not reported

COSTS ASSOCIATED WITH TELEMEDICINE (ACCURACY UNKNOWN)

A quick link to Grant Awards by Agency

Not reported

TECHNOLOGY AND COMMUNICATIONS USED

Technology amd Communications not reported.

CLINICAL SERVICES AND SPECIALTIES

None reported

TELEMEDICINE PERIPHERALS USED

Not reported

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TRICARE Southwest- Dod Lead Agent Office

(Project: Region VI Telemedicine Pilot Project)

(Project: Region VI Telepathology Network)

(Project: TRICARE Southwest Managed Care University)

Specific information regarding this facility has not been reported.

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Updated: 6/18/97

APPENDIX K

BAMC/GPRMC REVIEW OF TELEMEDICINE AND VTC

EQUIPMENT AND INVESTMENT COSTS

MEMORANDUM FOR Chairman, T-Med/VTC Working Group

SUBJECT: Review of Telemedicine (T-Med) and Videoteleconferencing (VTC) Equipment and Investment Costs, Project 97-22

1. INTRODUCTION.

a. Background. The initial purchase order for Telecommunication Services at BAMC, dated 28 June 1995, was for $1,116,226.00. Ten Telemedicine Systems, one Videoconferencing System, and Communication Systems Hardware were delivered and installed at BAMC, November and December 1995. Due to various problems, such as the move to the new BAMC and connectivity, most of the systems from the initial purchase were not used as envisioned. Six Global Med systems purchased through the Lead Agent were later installed at various departments in BAMC. The BAMC Property Book Office inventoried the systems, assigned them Materiel Management Control Numbers (MMCN) and estimated their costs.

b. Objective. To inventory Telemedicine and Videoconferencing equipment and determine total investment costs.

2. SOURCE/SCOPE.
The review was conducted for the most part according to generally accepted government auditing standards. The scope was limited to actual inventory of equipment by the Property Book Office and Internal Review, and examination of supporting documents, such as purchase requests, purchase orders, Military interdepartmental Purchase Requests (MIPR) and logs during September 1995 – December 1997. Field work was conducted at various departments in BAMC and HQRMC during July 1997 – December 1997.

3. RESULTS.

a. **Inventory.** There was no tracking system in place to accurately account for all T-Med/VTC equipment costs, installations, upgrades and maintenance since its inception at BAMC in1995. As a result, the enclosed inventory listing is presented to the working group to use as a baseline in establishing proper accountability for T-med/VTC equipment. The audit identified 23 T-Med and VTCs at BAMC, Wilford Hall Medical Center (WHMC) and HQ, GPRMC which are either on the BAMC property book or in the process of being added. The following observations were also noted:

SUBJECTL Review of Telemedicine (T-Med) and Videoteleconferencing (VTC) equipment and Investment Costs, Project 97-22

        (1) One system still in the BAMC warehouse since 1995 in open freight boxes appeared to have missing components.

        (2) A review of the initial 1995 purchase order showed a VTC system for the Commander and Communications Systems Hardware that we were not able to account for during the inventory. The current Communications System s Hardware on the inventory list was

b. Investment Costs

c.

4. <u>RECOMMENDATIONS.</u>

5. <u>Auditor Comment</u>.

APPENDIX L

GPRMC TELEMEDICINE/VTC WORKING GROUP NOTES

Subject: RE: Minutes of TMed/VTC Organizational Meeting 22 July.
Author: Michael Flahie at MEDCEN2_FSHTX
Date: 7/22/97 5:42 PM

Sirs/Ma'ams:
Immediately following this meeting, 1LT Bruno, Andries Tek personnel, and I did a survey of all the NEC equipment at BAMC. I will summarize the status of each unit, and the action to be taken to activate each unit NLT tomorrow AM. In general, we have units where there are no drops, and drops where there are no units. Clearly, in the time period between drop installation and the equipment being brought online, the equipment has suffered random brownian motion....Two units where found to be inoperable- one with no video (Codec problem), and one with no power. These will be repaired immediately. Most were lacking MMCN barcodes. Flahie

-----Original Message-----
From: LTC Daryl Zeigler
Sent: Tuesday, July 22, 1997 04:27 PM
To: Dwaine Brown; 1LT Sandra Bruno; LTC Jean Dailey; Michael Flahie; Vicky Hamlin; Herbert Jones; Gerrie Natalino; Evelyn Vergara; LTC Tom Wittman; COL John Roscelli; COL James Keeling; LTC Gary Simmons; LTC Jan Eagan; COL Dena A. Norton; COL Franklin Brooks; Pamelia Clement; dgoss@io.com

Cc: COL Toney Baskin; COL Joseph Gonzales; BG Harold Timboe
Subject: Minutes of TMed/VTC Organizational Meeting 22 July.
MCHE-PMR 22 July 1997

I. Meeting called to order by chair at 0835 in the Command Conference
Room BAMC.
II. Attendance (order of sign-in)
LTC Daryl Zeigler, C.Medical Informatics (Chairman) 6-1924
Vicki Hamlin Commo Branch, IMD 6-3600
Evelyn Vergara BAMC Internal Review 6-2009
Gerrie Natalino Computer Svcs Branch, IMD 6-3300
Pam Clement, PhD Dept.Psychology 6-5779
COL Franklin Brooks C.Dept.Psychology 6-1600
1LT Sandra Bruno Dept of Surgery 6-5414
COL John Roscelli C.Dept.Pediatrics 292-5097
COL James Keeling C.Dept.Dermatology 6-4408
LTC Jean Dailey Region VI Lead Agency 292-3217
Fred Chriswell Andries Tek, Chief Engineer 800-395-1331
Dirck Goss Andries Tek, Pres/CEO 800-395-1331
LTC Jan Eagan C.Clinical Informatics, DON 6-4817
Michael Flahie ACS IM, GPRMC 6-6042
Dwaine Brown HCSSA/MEDNET 265-2078
LTC Tom Wittman C.IMD, BAMC 6-4460
COL Dena Norton DON 6-1891
LTC Gary Simmons Dept. Radiology 6-4218
Herbert Jones LOG/Property Book 6-3132

III. Agenda

A. Clinical Problems/Issues
1. COL Berry, C.DOM, by written memorandum
2. COL Roscelli in attendance
3. COL Keeling in attendance
4. LTC Simmons in attendance
5. COL Norton/LTC Eagan in attendance

B. IMD Admin/Logistics/Internal Review/Lead Agent/GPRMC

1. Audit of hardware (include two units at WHMC)
2. Property Book/Hand Receipt to end using activity
3. Service contracts status

C. HCSSA/Andries Tek/GPRMC IMD BAMC
1. Connectivity issues
2. Scheduling of VTC/T-Med at HCSSA Bridge for >2 sites
3. Scheduling of Common Use Rooms -> BAMC IMD
4. Training of end users
5. Help Desk function in real time by IMD (6-HELP in planning stage). Goal of ONE phone number for end users to call for help. [and training?]
6. Command influence to obtain WHMC cooperation

IV. Tasking
A. Clinical area problems to be addressed by IMD/GPRMC/HCSSA and Andries Tek which involves hardware. drops and connectivity
B. Audit/property book/hand receipt and status of service contracts to be addressed by LOG/IR/IMD/GPRMC/Andries Tek Lead Agent
C. Scheduling of connectivity via MEDNET by HCSSA and "bridge"
D. Scheduling of VTC/T-Med rooms and equipment by user activity and by IMD for common use rooms including key control
E. Training of end users will be coordinated by IMD with input volunteered by HCSSA and Andries Tek
F. Help Desk function is being developed by IMD with near-term horizon for implementation
G. LTC Zeigler will brief COL Baskin and COL Gonzales on meeting and need for command influence at WHMC

V. Meeting adjourned at 1050 hrs.
VI. Next meeting will be announced via ccMail which will be the primary and preferred means of communication. Interim report on audit activity will be submitted NLT 7 August. BAMC-wide 100% inventory starting 11 August will aid in "finding" any "lost" hardware. VII. These are "dynamic minutes" in that anyone who attended the meeting should add to and amplify any aspect of the agenda and taskings. Please. however, reply to ALL ADDRESSEEs so that all will be able to respond.

Daryl N. Zeigler
LTC. MC
Chief. Medical Informatics. BAMC

From: Zeigler. LTC Daryl
Sent: Friday. August 15, 1997 4:48 PM
To: Brown. D; Brooks. COL Franklin ; LTC Jean Dailey at Internet-Mail:
Wittman, LTC Tom : BAMC. Chief Resident DOM ; Bruno, 1LT Sandra ; Bulgrin, Jim ;
Hamlin. Vicky : Vergara. Evelyn ; Jones, Herbert ; Roscelli, COL John ; Keeling,
COL James : Berry. COL Michael ; Thompson. COL Ian ; Natalino, Gerrie ; Trawick,
Kenneth ; dgoss@io.com; Eagan. LTC Jan ; Norton, COL Dena A.
Cc: Gonzales. COL Joseph ; Baskin. COL Toney ; Timboe, BG Harold
Subject: Minutes of the 2nd T-Med/VTC Working Group, 14 Aug 97 Minutes of the T-Med/VTC Working Group

A. The group's second meeting took place on 14 August from 0830-0930 in the Command Conference Room.

B. Attendance:
COL Franklin Brooks. C, Dept. Psychology
LTC Jean Dailey. Lead Agency Representative
LTC Tom Wittman. C. IMD
CPT Bill Dixon. Chief Resident. Dept. of Medicine
1LT Sandra Bruno (Laska). Admin. Dept. of Surgery
Mr. Jim Bulgrin. Cardiology Service
Ms Vicky Hamlin. Commo Br., IMD
Ms Evelyn Vergara. BAMC Internal Review
Mr. Herbert Jones. Sr.. Property Book Officer, LOG
LTC Daryl Zeigler. Chairman

C. OLD BUSINESS:
1. Follow up of the clinical areas represented at first meeting plus Cardiology. Problems and connectivity issues
were identified by the Depts. of Medicine, Dermatology. Pediatrics. Psychology plus Cardiology Service.

a. Report on measures to correct meeting #1 clinician identified concerns of reliability (LTC Wittman, Ms Hamlin)
1) Re: Dept. of Medicine to/from DACH.

DISCUSSION: The distance from DACH to the Primary Care Track site (TREMMIER CLINIC) is over 3 miles. The
issue is audio drop-out. not video drop-out. Cabling is suspect.
CONCLUSION: The cabling/wiring between DACH and the Clinic is not up to par for use in VTC.
ACTIONS:
a) Determine the cost of upgrading and laydown of cabling plus the time-line to accomplish this.
b) If a) will take more than 2 months to accomplish, temporarily conduct VTC at DACH where reliability has been
shown.
c) Follow up: CPT Dixon, Ms Hamlin, LTC Wittman
d) POC @ Ft Hood in DOM is Cpt Howser (254)634-7647.
b. 1LT Bruno reports an incident in which between 0700-0800 on ~Tuesday of this week, Ophthalmology Service
was conducting a three-way VTC with WHMC and UT-Galveston.

DISCUSSION: At some point. UTHSC-SA audio intruded on the three-way VTC. How this happened is not yet
known.
CONCLUSION: It is obviously an embarassment for this sort of thing to happen, in addition to the great annoyance
and disruption it causes.
ACTIONS: Ms Hamlin will check with HCSSA/USAMISSA for troubleshooting this issue. 1LT Bruno will provide
precise date and time for assisting in assessment of MEDNET LOG files.

c. On Tuesday. 12 August at 1430. BG Timboe and a reporter for the Mercury were to participate in a VTC with
COL Farmer. CMDR of DACH. for the "Hospital Without Walls" follow up story. All connectivity was properly
checked out earlier in the day. but at "show time", connectivity with DACH was nonexistent, and connectivity with

GPRMC (Mr. Flahie) was up and down repeatedly. Mr. Flahie reported telephonically and Ms Hamlin at this meeting that adjustments of some sort were being performed at HCSSA/USAMISSA who showed NO SCHEDULED VTC events on their "bridge" schedule.

CONCLUSION: Since BAMC has dial anywhere capability between it and one other site, no scheduling through the "bridge" at HCSSA/USAMISSA is required. However, communication is essential to prevent this major disruption of a BAMC mission. The missions of BAMC take precedence over scheduled, non emergency work on any of it'sIM/IT systems.
ACTION: Ms Hamlin/LTC Wittman have indicated that before the end of FY97, at least two full time contract personnel will be hired to handle HELP and SCHEDULING functions. The USAMISSA must CLEAR with BAMC before any routine maintenance is to be performed on MEDNET, etc.

2. Follow up inventory of equipment and operational status of all BAMC units (including two at WHMC).

DISCUSSION: A critical starting point to move VTC/T-Med forward from "stove pipery" to an integrated, comprehensive entity is full accountability of assets in all areas. A three hour walk about inventory was conducted by Mr. Flahie, 1LT Bruno (Laska), Ms. Vergara, LTC Dailey, and Mr. Jones after the first meeting last month. Mr. Jones reports that the BAMC 100% inventory is underway and will add further details to the ad hoc inventory just described.
CONCLUSION: A list has not yet been compiled or provided which comprehensively lists BAMC assets for T-Med/VTC at BAMC or at WHMC. This is a pending action per Mr. Mike Flahie.
ACTION: Mr. Flahie's list to follow by next meeting.

3. Follow up for location of drops at BAMC and WHMC.
ACTION: This is rolled up into Mr. Flahie's report.

4. Follow up about staffing for centralized HELP, SCHEDULING, and TRAINING.

ACTION: The hiring of two contract personnel to full time T-Med/VTC is planned to handle the HELP and SCHEDULING functions. Offers from Andries Tech and Dwaine Brown of HCSSA to help in the TRAINING aspects were offered at last meeting. The TRAINING piece needs further definition and delineation. Follow up by Ms Hamlin, LTC Wittman.

D. NEW BUSINESS:
1. CPT Dixon reports potential utilization of VTC/T-Med by DOM at 9/week to/from DACH.

2. Cardiology Service, Mr. Bulgrim representing, requests relocation of Cardiology Conference Room gear to an adjacent room (331-5) as upgrade of existing conferencingcapability is occuring. Additional inquiry about connectivity within BAMC among other VTC sites was answeredaffirmative by Ms. Hamlin LTC Wittman/LTC Zeigler, for POINT-TO-POINT, ONE-TO-ONE service only.

CONCLUSION: Clinical VTC/T-Med need identified.
ACTION: Ms. Hamlin, et al from IMD will work with Cardiology to accomplish upgrades and connections. Work the issue of how more than two sites within BAMC could be connected. Internal BAMC "bridge"?

3. Re: Other clinical areas not represented at this meeting. CONCLUSION: All clinical areas must have input for current needs assessment and formulation of VTC/T-Med utilization plans.

ACTIONS: 1LT Bruno will survey DOS subspecialty clinics. CPT Dixon will survey DOM subspecialty clinics. COL Brooks will survey Psychiatry and Social Work and Ms Hamlin will survey all other separate Departments/Services for issues of reliability for VTC in current use, and determine need for VTC/T-Med within each area.
FOLLOW UP: A comprehensive picture of the clinical areas at BAMC should emerge by next month's meeting.

4. Expanding the notion of a BAMC inventory and connectivity survey to include all MTFs in GPRMC to plan for greater VTC/T-Med connectedness with and among each other and BAMC.

DISCUSSION: Since connectivity is dependent on the status of all parties, and the status of all MTF T-Med/VTC capability is still largely unknown, a complete inventory of hardware assets and drops must be known throughout GPRMC and the city of San Antonio. Each MTF IMO must work closely with the clinical side to pinpoint location for T-Med/VTC equipment placement and location of drops.
CONCLUSION: Deficient data on connectivity within GPRMC/SATX.
ACTION: Mr Flahie has been in contact with IMOs throughout GPRMC and the T-Med/VTC initiative for Emergency Departments directed by BG Timboe is now adding impetus. By next meeting, the inventory will be ready for distribution and discussion.

5. Opening a dialogue with WHMC in establishing the military links for VTC/T-Med city wide with UTHSC-SA is an urgent issue.

DISCUSSION: City-wide medical center T-Med/VTC connectivity has been identified as indispensible by echelons well placed at OTSG, UTHSC-SA President and Texas legislative levels, but has been stymied due to several factors. Between today's meeting and the first meeting of this working group, COL Baskin, LTC Wittman, Mr. Flahie and LTC Zeigler met to discuss issues with bearing on our current lack of connectivity with WHMC.
CONCLUSION: Roadblocks exist that shouldn't.
ACTION: An issues memorandum will be prepared for submission to COL Baskin which will lead to command level dialogue to ease chronic blocks to mission accomplishment.

6. Meeting adjourned at 0930. Next meeting will take place on 4 September, 0830-1000 in the Command Conference Room.

Daryl N. Zeigler
LTC, MC
Chairman
Chief, Medical Informatics and Telemedicine

Minutes of the T-Med/VTC Working Group 4 Sept 97
A. The group's third meeting took place on 4 September from 0830-1000 in the Command Conference Room.

B. Attendance:
1. Present
LTC Jean Dailey, Lead Agency Region #6 (292-3217) LTC Tom Wittman, C, IMD (6-4460)
Ms Gerrie Natalino, Computer Svc Br, IMD (6-3300)
Ms Vicky Hamlin, Commo Br., IMD (6-3600)
Mr Bob Meints, Lead Agency Region #6 (292-3240)
CPT Bill Dixon, Chief Resident, Dept. of Medicine (6-1414)
Mr Jim Bulgrin, Cardiology Service (6-2268)
Mr Dwaine Brown, USAMISSA/HCSSA (265-2078)
COL Rohini Daniels, C, DPALS (6-3311)
Mr Ed Ng, Nutrition Care Division (6-3372)
Ms Evelyn Vergara, BAMC Internal Review (6-2009)
LTC Daryl Zeigler, Chairman (6-1924)

2. Absent
Pam Clement, PhD, Dept. of Psychology (6-5779)
COL Franklin Brooks, C, Dept. of Psychology (6-1600)
Mr Herbert Jones, Sr., Property Book Officer, LOG (6-3132)
Mr Mike Flahie, ACS for IM, GPRMC (6-6042)
ILT Sandra Bruno, Dept. of Surgery (6-5414)
COL John Roscelli, C, Dept. of Pediatrics (292-5097)
COL James Keeling, C, Dept. of Dermatology (6-4408)
Mr Fred Chriswell, Andries Tek, Chief Engineer (800-395-1331)
Mr Dirck Goss, Andries Tek, Pres/CEO (800-395-1331)
LTC Jan Eagan, C, Clinical Informatics, DON (6-4817)
COL Dena Norton, DON (6-1891)
LTC Gary Simmons, Dept. of Radiology (6-4218)

C. OLD BUSINESS:
1. Follow up of clinical areas.

a. Dept. of Medicine to/from DACH.
DISCUSSION: The distance from DACH to the Primary Care Track site (TREMMIER CLINIC AC3) is over 3 miles. The issue is audio drop-out, not video drop-out. Cabling was suspect, but Mr Brown and Ms Hamlin state that the manner of connection between AC3 and DACH is not optimal.
CONCLUSION: Connectivity between DACH and the Tremmier Clinic is not up to par for use in VTC.

ACTIONS:
FOLLOW UP: CPT Dixon, Ms Hamlin, Mr Brown
POC @ Ft Hood in DOM is Cpt Howser (254)634-7647.

b. Audio intrusion from UTHSC-SA on an Ophthalmology Service three-way VTC with WHMC and UT-Galveston.
DISCUSSION: Mr Brown reports investigation of the problem detected a hardware problem at the V-Tel bridge of UTHSC-SA. This is actively being remedied.

CONCLUSION: Problem identified.
ACTIONS: To prevent similar problems originating from his area, Mr Brown has examined HCSSA/USAMISSA bridge operations with process improvement as a goal. This has lead to designating separate "black boxes" for T-

Med (patient care) from VTC (talking heads) use. Access will be greatly limited to the patient care "box". FOLLOW UP: Mr. Brown on status of UTHSC-SA V-Tel

c. Cardiology Service. Mr. Bulgrim. requested relocation of Cardiology Conference Room gear to an adjacent room (331-5) as upgrade of existing conferencing capability is occuring. Additional inquiry about connectivity within BAMC among other VTC sites was answered affirmative by Ms. Hamlin/LTC Wittman/LTC Zeigler. for POINT-TO-POINT, ONE-TO-ONE service only.

CONCLUSION: Clinical VTC/T-Med need identified.
ACTION: Ms. Hamlin. et al from IMD will work with Cardiology to accomplish upgrades and connections. Work the issue of how more than two sites within BAMC could be connected. Internal BAMC "bridge"?
FOLLOW UP: next meeting

d. Re: Other clinical areas not represented at any meetings to date.

DISCUSSION: All clinical areas must have input for current needs assessment and formulation of VTC/T-Med utilization plans. CONCLUSION: Clinical area recruitment needed.
ACTIONS: 1LT Bruno will survey DOS subspecialty clinics, CPT Dixon will survey DOM subspecialty clinics. COL Brooks will survey Psychiatry and Social Work and Ms Hamlin will survey all other separate Departments/Services for issues of reliability for VTC in current use, and determine need for VTC/T-Med within each area.
FOLLOW UP: A comprehensive picture of the clinical areas at BAMC should emerge by next month's meeting.
FOLLOW UP: No report this meeting since COL Brooks and 1LT Bruno not present and Ms Hamlin/CPT Dixon did not report in interest of time. Reports due next meeting.

2. Follow up of command areas.
a. Problem with failed VTC between BG Timboe and COL Farmer, CMDR of DACH, in August.
DISCUSSION: All connectivity was properly checked out earlier in the day. but at "show time", connectivity with DACH was nonexistent, and connectivity with GPRMC (Mr. Flahie) was up and down repeatedly. Mr. Flahie reported telephonically and MsHamlin at last meeting that adjustments of some sort were being performed at HCSSA/USAMISSA who showed NO SCHEDULED VTC events on their "bridge" schedule. CONCLUSION: Since BAMC has dial anywhere capability between it and one other site, no scheduling through the "bridge" at HCSSA/USAMISSA is required. However, communication is essential to prevent this major disruption of a BAMC mission. The missions of BAMC take precedence over scheduled, non emergency work on any of it's IM/ITsystems.
ACTIONS:
a) Ms Hamlin/LTC Wittman have indicated that before the end of FY97, at least one full time contract person will be hired to handle HELP. TRAINING and SCHEDULING functions.
b) The USAMISSA must CLEAR with BAMC before any routine maintenance is to be performed on MEDNET. etc. POC: Mr. Brown FOLLOW UP: This will be carried as an active problem until after new personnel have been hired and trained.

3. Follow up inventory of equipment and operational status of all BAMC units (including two at WHMC).
DISCUSSION: A critical starting point to move VTC/T-Med forward from "stove pipery" to an integrated. comprehensive entity is full accountability of assets in all areas. Ms Vergara reports that the BAMC 100% inventory is underway but not complete. She is working with Mr Jones of BAMC LOG. There is not yet a full accountability for the Lead Agent unit still sitting in the BAMC "warehouse" nor do they have access so far to the two units at WHMC. Other equipment such as that of Cardiology Service hasn't appeared on the survey, so all clinical areas need to be entered into the database for full accountability. Costing of units identified from invoices is ongoing. This information is needed to know what our "up front" costs in infrastructure/equipment is to calculate cost effectiveness of VTC/T-Med down the road.
CONCLUSION: Inventory and cost basis is not yet complete. ACTIONS:
a) Ms Natalino will call the WHMC IMO POC to arrange for the visit of Ms Vergara and Mr Jones to inventory BAMC units located there.
b) Lead Agent (LTC Dailey) and GPRMC (Mr Flahie) to provide additional data.

4. Follow up for location of drops at BAMC and WHMC.

ACTION: This is rolled up into Mr. Flahie's report to the committee next meeting.

5. Follow up about staffing for centralized HELP, SCHEDULING, and TRAINING.
ACTION:
a) The hiring of one contract person to full time T-Med/VTC is planned to handle the HELP, TRAINING and SCHEDULING functions. Offers from Andries Tech and Dwaine Brown of HCSSA/USAMISSA to help in the TRAINING aspects have been made.
b) Follow up by Ms Hamlin, LTC Wittman. 6. Follow up of expanding the notion of a BAMC inventory and connectivity survey to include all MTFs in GPRMC to plan for greater VTC/T-Med connectedness with and among each other and BAMC. DISCUSSION: Since connectivity is dependent on the status of all parties, and the status of all MTF T-Med/VTC capability is still largely unknown, a complete inventory of hardware assets and drops must be known throughout GPRMC and the city of San Antonio. Each MTF IMO must work closely with the clinical side to pinpoint location for T-Med/VTC equipment placement and location of drops.
CONCLUSION: Deficient data on connectivity within GPRMC/SATX.
ACTION: Mr Flahie has been in contact with IMOs throughout GPRMC and the T-Med/VTC initiative for Emergency Departments directed by BG Timboe is now adding impetus.
FOLLOW UP: no report this meeting.

7. Follow up re: Opening a dialogue with WHMC in establishing the military links for VTC/T-Med city wide with UTHSC-SA is an urgent issue.
DISCUSSION: City-wide medical center T-Med/VTC connectivity has been identified as indispensible by echelons well placed at OTSG, UTHSC-SA President and Texas legislative levels, but has been stymied due to several factors. Between last meeting and the first meeting of this working group, COL Baskin, LTC Wittman, Mr. Flahie and LTC Zeigler met to discuss issues with bearing on our current lack of connectivity with WHMC.
CONCLUSION: Roadblocks exist that shouldn't.
ACTION: An issues memorandum will be prepared forsubmission to COL Baskin which will lead to command level dialogue to ease chronic blocks to mission accomplishment.
FOLLOW UP: An issues memorandum was sent to COL Baskin by LTC Zeigler, action pending.

D. NEW BUSINESS:
1. Cardiology Service. Mr Bulgrim.
DISCUSSION: Mr Bulgrim inquired about store-and-forward capability for echocardiologic studies. They will be using DICOM files.
CONCLUSION: Mr Brown stated this would not be a problem.
ACTION: POC: Mr. Bulgrim

2. Pediatrics, through LTC Dailey by conversation with LTC Heiman,
Dept. of Peds.
DISCUSSION: Pediatrics group desires connection of the unused NEC VTC/T-Med equipment on the 8th floor of WHMC for VTC within the GPRMC
CONCLUSION: Underutilized asset now sees a new mission.
ACTION: Ms Natalino will contact the IMO POC at WHMC about putting a drop in the area designated by Pediatrics. WHMC has a contract with the TELCO for this hardwiring type work.

3. Lead Agent, Region #6, LTC Dailey
DISCUSSION: LTC Dailey reports an upgrade initiative now starting for the AT&T House Call Global Med software.
CONCLUSION: Arrangements required.
ACTION: LTC Dailey will notify affected areas with VTC equipment of this upgrade availability

4. Department of Pathology and Area Labs, COL Daniels
DISCUSSION: COL Daniels requests T-Med and VTC level connectivity among the MTFs of GPRMC. Currently each MTF is connected to AFIP by POTS (plain-old-telephone-service) with poor resolution of histopathology slide images.
CONCLUSION: Critical diagnostic decisions rely on high quality images.

ACTIONS: Mr Brown states that the MEDNET can support the mission described. He will work with the other MTF sites along with Mr Flahie and Lead Agency (Mr Meints). POC: COL Daniels.

5. Nutrition Care Division. Mr Ng
DISCUSSION: The NCD education and training mission requires VTC connectivity among several MTFs and institutions.
CONCLUSION: Mission identified and justified.
ACTIONS: Ms Natalino will facilitate contact with the technical areas
POC: Mr Ng

6. USAMISSA/HCSSA. Mr Brown
DISCUSSION: Mr Brown gave the group the number to call for scheduling the bridge for multipoint teleconferencing. That number is 221-9706.
CONCLUSION: This and other key numbers and POCs should be available at each VTC/T-Med unit.
ACTION: Compilation of a user resource will fall within the domain of the person hired to the HELP, TRAINING, and SCHEDULING position. Action pending hire.

7. Meeting adjourned at 1000. Next meeting will take place on 21 October. 0830-1000 in the Command Conference Room.

Daryl N. Zeigler
LTC, MC
Chairman
Chief, Medical Informatics and Telemedicine

Minutes of the T-Med/VTC Working Group 21 October 97

A. The group's fourth meeting took place on 21 October from 0830-1000 in the Radiology Conference Room.

B. Attendance:

1. Present
LTC Jean Dailey. Lead Agency Region #6 (292-3217)
LTC Tom Wittman. C. IMD (6-4460)
Ms Vicky Hamlin. Commo Br.. IMD (6-3600)
Mr Jim Bulgrin. Cardiology Service (6-2268)
Mr Dwaine Brown. USAMISSA/HCSSA (265-2078)
Ms Evelyn Vergara. BAMC Internal Review (6-2009)
Mr Dirck Goss. Andries Tek. Pres/CEO (800-395-1331)
LTC Kathleen David-Bajar. Dermatology (6-4408) vice COL James A.
Keeling. C, Dermatology Department
1LT Sandra Bruno. Patient Admin Section (6-2320)
2LT Dan Bridon. IMD (6-1779)
Ms Mary Jane Tuttle. Dept. of Surgery (6-5266/513-5539)
LTC Daryl Zeigler. Chairman (6-1924/513-1924)

2. Absent
Ms Gerrie Natalino. Computer Svc Br. IMD (6-3300)
Pam Clement. PhD. Dept. of Psychology (6-5779)
COL Franklin Brooks. C. Dept. of Psychology (6-1600)
Mr Herbert Jones. Sr.. Property Book Officer. LOG (6-3132)
Mr Mike Flahie. ACS for IM. GPRMC (6-6042)
COL John Roscelli. C. Dept. of Pediatrics (292-5097)
Mr Fred Chriswell. Andries Tek. Chief Engineer (800-395-1331)
LTC Jan Eagan. C. Clinical Informatics. DON (6-4817)
COL Dena Norton. DON (6-1891)
LTC Gary Simmons. Dept. of Radiology (6-4218)
Mr Bob Meints. Lead Agency Region #6 (292-3240)
CPT Bill Dixon. Chief Resident. Dept. of Medicine (6-1414)
COL Rohini Daniels. C. DPALS (6-3311)
Mr Ed Ng. Nutrition Care Division (6-3372)

3. Guests
Sigrid Gustafson. PhD. Virginia Tech/AMEDD Board (540-231-3133)
Robert "Bobbie" A. Dean. IMD coming on board introduction

C. NEW BUSINESS:
1. LTC Zeigler brought up the controversy surrounding a new MEDCOM policy which has caused a public relations SNAFU with WHMC and UTHSC-SA. MEDCOM has declared a three tiered priority for use of the MEDCOM "bridge". #1 True Telemedicine consultations with patient care as the primary mission. #2 General Officer's videoconferencing mission. #3 Videoconferencing for administrative purposes. Since the finalized. signed policy is notavailable for review. it is not currently known if medical education (CME/GME) will be considered in priority #1 or #3. The bandwidth limitation of 128 Kbps will be used for priority #3. 384 Kbps for priority #2. and whatever is required for priority #1. "Bumping" of scheduled events will be in rank order of priority #1>#2>#3 as far as who does the
bumping of whom.

This policy. as Mr. Brown points out. will not affect point-to-point connectivity that does not pass through the MEDCOM bridge. Mr. Flahie has pointed out (in absentia by a message) that 128 Kbps should allow enough resolution using "freeze frame". but will be very unsatisfactory for motion of any kind.

F/U: The impact of this new policy will be monitored and reported next meeting by LTC Zeigler.

2. LTC Zeigler introduced Dr Sigrid Gustafson who is working under contract with AMEDD Board to conduct research on Telemedicine utilization for outcomes and cost savings. She has already worked with Dr. Kobylarz and others to line up DACH at Ft Hood in the research endeavor. She, Ms Linda Drzymalla, Ms Adrea Gulledge, Mr Walt Prescher and LTC Zeigler met yesterday to go over the new ADS v.2.0 "bubble sheet" which will add one line to the "clinical use only" section for "Telemedicine Consultation...A=yes, B=no". This will be added only to the clinics which have an active telelemedicine consultation initiative and be used for collection of data.

3. Ms Vicky Hamlin introduced Bobbie Dean, who is hired into IMD for the SCHEDULING, TRAINING and HELP functionality for which BAMC's Videoconferencing and Telemedicine efforts will greatly benefit.

D. OLD BUSINESS:

1. Follow up of clinical areas.

a. Dept. of Medicine

1) Conversion of DOM, BAMC. conference room from point-to-point with Tremmier Clinic, Ft Hood to dial-anywhere capability in preparation for a 13, 14 November Army American College of Physicians videoconference coming from WRAMC across the AMEDD. Mr Ken Trawick of USAMISSA and AndriesTek are working the technical aspects of the conversion and connectivity. November 6 is the deadline to have all aspects installed and checked out.

2) Conversion of the Tremmier Clinic at Ft Hood to dial-anywhere connectivity. This is being worked by Mr Ed Pitts at Ft Hood. AndriesTek. and USAMISSA.
FOLLOW UP: AndriesTek. CPT Dixon. Ms Hamlin, Mr Brown, POC @ Ft Hood in
DOM is Cpt Howser (254)634-7647.

b. Cardiology Service. Mr. Bulgrin. requested relocation of Cardiology Conference Room gear to an adjacent room (331-5) as upgrade of existing conferencing capability is occurring.

CONCLUSION: Clinical VTC/T-Med need identified.
ACTION: Ms. Hamlin, et al from IMD will work with Cardiology to
accomplish upgrades and connections.
ACTION: The GlobalMed (AT&T)/CLI equipment is not dial-anywhere and
will require further hardware solutions.
F/U: Lead Agent, BAMC IMD Commo Br. to report next meeting.

c. Dermatology
Need conversion of their equipment to dial-anywhere
F/U: Lead agent
d. Nutrition Care Directorate Need VTC equipment. drops, the whole request reviewed and negotiated.
F/U: Mr Ng, Ms Hamlin, Mr Flahie

e. Pediatrics
Need to move the NEC unit from 8th floor Peds at WHMC to BAMC Peds clinic. remove unit in Peds Clinic to WHMC portable classroom #2 for COL Roscelli's morning rounds conference. Need to check status of Peds equipment and connectivity at DACH.
F/U: Lead Agent. 1LT Bruno. Ms Hamlin. AndriesTek

f. Department of Surgery
Ms Tuttle reported on the desired locations for VTC. The primary sites are Chief. DOS office area (270-20) with another site to be named. Two items of equipment are listed as a desktop unit and a NEC unit.
F/U: Lead Agent, AndriesTek. Ms Hamlin. Ms Tuttle

g. Clinical Psychology Service
No report this meeting.
F/U: COL Brooks, Dr Clement

h. Department of Pathology and Area Labs
No report this meeting
F/U: COL Daniels, AndriesTek

i. Emergency Departments BAMC and GPRMC
Directed by BG Timboe. Awaiting input from BAMC EMD.
F/U: COL Pfaff, LTC Sheridan

j. ENT
No representation yet.
F/U MAJ Mahoney

2. Follow up inventory of equipment and operational status of all BAMC units (including two at WHMC). Ms Vergara reports nearly a nearly completed inventory but must meet with Mr Jones to reconcile with the BAMC 100% inventory in September. She is also attempting to track down the purchase price of all VTC equipment purchased and in inventory. This information will serve as a cost of "overhead" and initial investment to determine the point of return on investment.
F/U: Lead Agent, Ms Vergara and Mr Jones (see attached file "bamcin~1.xls")

3. Location of drops at BAMC, DACH. (see attached files "dropsnew.xls" and "nec_num1.xls")
F/U: Pending Mr Flahie's report to the committee next meeting.

4. Expanding the notion of a BAMC inventory and connectivity survey to include all MTFs in GPRMC to plan for greater VTC/T-Med connectedness with and among each other and BAMC.
F/U: Pending Mr Flahie's report to the committee next meeting.

5. Dialogue with WHMC in establishing the military links for
VTC/T-Med city wide with UTHSC-SA. Meetings have taken place between WHMC and BAMC IMOs. Dialogue is ongoing citywide with LTC Zeigler and Dr Gustafson's participation in the Telehealth initiative meeting at UTHSC-SA yesterday.
F/U: This will not be reported in future minutes. Action closed.

6. Meeting adjourned at 0945. Next meeting will take place on 18 November, 0830-1000 in the Radiology Conference Room.

Daryl N. Zeigler
LTC, MC
Chairman
Chief, Medical Informatics and Telemedicine

Closed/Retired Actions:
a. Audio intrusion from UTHSC-SA on an Ophthalmology Service three-way VTC with WHMC and UT-Galveston.

DISCUSSION: Mr Brown reports investigation of the problem detected a hardware problem at the V-Tel bridge of UTHSC-SA. This is actively being remedied.
CONCLUSION: Problem identified.
ACTIONS: To prevent similar problems originating from his area, Mr Brown has examined HCSSA/USAMISSA bridge operations with process improvement as a goal. This has lead to designating separate "black boxes" for T-Med (patient care) from VTC (talking heads) use. Access will be greatly limited to the patient care "box".
FOLLOW UP: Mr. Brown on status of UTHSC-SA V-Tel
ACTION: Closed due to no further action deemed appropriate.

b. Follow up of command areas. Problem with failed VTC between BG Timboe and COL Farmer, CMDR of DACH. in August.
DISCUSSION: All connectivity was properly checked out earlier in the day, but at "show time", connectivity with DACH was nonexistent, and connectivity with GPRMC (Mr. Flahie) was up and down repeatedly. Mr. Flahie reported telephonically and Ms Hamlin at last meeting that adjustments of some sort were being performed at HCSSA/USAMISSA who showed NO SCHEDULED VTC events on their "bridge" schedule.
CONCLUSION: Since BAMC has dial anywhere capability between it and one other site, no scheduling through the "bridge" at HCSSA/USAMISSA is required. However, communication is essential to prevent this major disruption of a BAMC mission. The missions of BAMC take precedence over scheduled, non emergency work on any of it's IM/IT systems.

ACTIONS:
a) Ms Hamlin/LTC Wittman have indicated that before the end of FY97, at least one full time contract person will be hired to handle HELP. TRAINING and SCHEDULING functions.
b) The USAMISSA must CLEAR with BAMC before any routine maintenance is to be performed on MEDNET, etc. POC: Mr. Brown
FOLLOW UP: Mr Brown reported no log evidence of network failure or "adjustments" being performed.
ACTION: closed.

Minutes of the T-Med/VTC Working Group 18 November 97
A. The group's fifth meeting took place on 18 November from 0830-1000 in the Radiology Conference Room. B.

Attendance:

1. Present
LTC Jean Dailey, Lead Agency Region #6 (292-3217)
Ms Vicky Hamlin, Commo Br., IMD (6-3600, 513-9410)
Mr Bobby Dean, VTC/T-Med Administrator, IMD, (6-2882, 513-1910)
Mr Jim Bulgrin, Cardiology Service (6-2268)
Mr Herbert Jones, Sr., Property Book Officer, LOG (6-3132)
LTC Kathleen David-Bajar, Dermatology (6-4408) vice
COL James A. Keeling, C, Dermatology Department
Mr Fred Chriswell, Andries Tek, Chief Engineer (800-395-1331)
Mr Frank Murphy, HCSSA/SAIC (265-2090)
Mr Mike Flahie, ACS for IM, GPRMC (6-6042)
LTC Daryl Zeigler, Chairman (6-1924, 513-1924)

2. Absent
LTC Tom Wittman, C, IMD (6-4460)
Ms Gerrie Natalino, Computer Svc Br, IMD (6-3300)
Pam Clement, PhD, Dept. of Psychology (6-5779)
COL Franklin Brooks, C, Dept. of Psychology (6-1600)
COL John Roscelli, C, Dept. of Pediatrics (292-5097)
LTC Jan Eagan, C, Clinical Informatics, DON (6-4817)
COL Dena Norton, DON (6-1891)
LTC Gary Simmons, Dept. of Radiology (6-4218)
Mr Bob Meints, Lead Agency Region #6 (292-3240)
CPT Bill Dixon, Chief Resident, Dept. of Medicine (6-1414)
COL Rohini Daniels, C, DPALS (6-3311)
Mr Ed Ng, Nutrition Care Division (6-3372)
Mr Dwaine Brown, USAMISSA HCSSA (265-2078)
Ms Evelyn Vergara, BAMC Internal Review (6-2009)
Mr Dirck Goss, Andries Tek, Pres CEO (800-395-1331)
1LT Sandra Bruno, Patient Admin Section (6-2320)
2LT Dan Bridon, Security Officer, IMD (6-1779)
Ms Mary Jane Tuttle, Dept. of Surgery (6-5266/513-5539)

3. Guest
Mr Ken Weber, USAIAR/IM (6-3678)

C. OLD BUSINESS:
1. Follow up of clinical areas.

a. Dept. of Medicine

1) Conversion of DOM, BAMC, conference room from point-to-point with Tremmier Clinic, Ft Hood to dial-anywhere capability in preparation for a 13, 14 November Army American College of Physicians videoconference coming from WRAMC across the AMEDD. Mr Ken Trawick of USAMISSA and AndriesTek are working the technical aspects of the conversion and connectivity. November 6 is the deadline to have all aspects installed and checked out.

2) Conversion of the Tremmier Clinic at Ft Hood to dial-anywhere connectivity. This is being worked by Mr Ed Pitts at Ft Hood, AndriesTek, and USAMISSA.

FOLLOW UP: (18 NOV 97)

1) The DOM Conf Rm was used on 13 and 14 NOV 97 for a live VTC from Washington, DC for the Army American College of Physicians annual meeting. The DOM NEC unit was not operational in time, so a new PictureTel unit was retrieved from warehouse, assembled, installed, and worked flawlessly throughout the two day meeting.

2) Problems that have not yet been solved remain in connecting DOM-BAMC to Tremmier Clinic-DACH.

ACTION: (18 NOV 97)
1) NEC equipment will be renovated and returned to DOM. The PictureTel unit will be pulled back for reserve.
2) POCs: AndriesTek, CPT Dixon, Ms Hamlin, Mr Brown, and POCs @ Ft Hood in DOM is Cpt Howser (254)634-7647 and Mr Ed Pitts for DACH IMD. b. All other Clinical Areas previously reported: (18 NOV 97) A mark is on the wall for completing all dial-anywhere conversions of BAMC VTC/T-Med equipment with hot wall drops, line drivers, teleos port connectivity for a 100% operational scenario by 31 DEC 97. ACTION: The ball is in the engineering/technical court to meet this goal. All clinical area POCs have their name and phone/pager number listed in all minutes of this working group since inception.

F/U: Mr Flahie, Mr Brown, Mr Criswell, Mr Murphy, Mr Dean, Ms Hamlin
c. Emergency Departments BAMC and GPRMC
Directed by BG Timboe. Awaiting input from BAMC EMD.
F/U: COL Pfaff, LTC Sheridan
ACTION: (18 nov 97) LTC Zeigler will seek clarification of BG Timboe's intent on this issue and will meet with the CG and COL Baskin on 16 DEC 97 in lieu of a December VTC/T-Med WG meeting.

2. Follow up inventory of equipment and operational status of all BAMC units (including two at WHMC). Ms Vergara reports nearly a nearly completed inventory but must meet with Mr Jones to reconcile with the BAMC 100% inventory in September. She is also attempting to track down the purchase price of all VTC equipment purchased and in inventory. This information will serve as a cost of "overhead" and initial investment to determine the point of return on investment.

F/U: Lead Agent, Ms Vergara and Mr Jones
ACTION: (18 NOV 97) Still no report of total inventory or of initial $$ outlay for current inventory.
FOLLOWUP: Lead Agent, Ms Vergara and Mr Jones at January meeting. 3. Expanding the notion of a BAMC inventory and connectivity survey to include all MTFs in GPRMC to plan for greater VTC/T-Med connectedness with and among each other and BAMC.
F/U: Mr Flahie
ACTION: (18 NOV 97) Mr Flahie did report that BAMC has up to 32 ports for VTC/T-Med connectivity which should be adequate for current and future needs based on projections without new equipment being added to the inventory.
F/U: Pending Mr Flahie's report to the committee in January '98.

4. LTC Zeigler brought up the controversy surrounding a new MEDCOM policy which has caused a public relations SNAFU with WHMC and UTHSC-SA. MEDCOM has declared a three tiered priority for use of the MEDCOM "bridge". #1 True Telemedicine consultations with patient care as the primary mission. #2 General Officer's videoconferencing mission. #3 Videoconferencing for administrative purposes. Since the finalized, signed policy is not available for review, it is not currently known if medical education (CME/GME) will be considered in priority #1 or #3. The bandwidth limitation of 128 Kbps will be used for priority #3, 384 Kbps for priority #2, and whatever is required for priority #1. "Bumping" of scheduled events will be in rank order of priority #1>#2>#3 as far as who does the bumping of whom. This policy, as Mr. Brown points out, will not affect point-to-point connectivity that does not pass through the MEDCOM bridge. Mr. Flahie has pointed out (in absentia by a message) that 128 Kbps should allow enough resolution using "freeze frame", but will be very unsatisfactory for motion of any kind.
F/U: The impact of this new policy will be monitored and reported next meeting by LTC Zeigler. ACTION: (18NOV 97) LTC Zeigler reported a favorable response to the new policy draft. Review of the new policy draft was performed by personnel at USAHSC-SA and WHMC.
F/U: Monitoring is no longer needed so this issue will be dropped from future minutes.

5. LTC Zeigler introduced Dr Sigrid Gustafson who is working under contract with AMEDD Board to conduct research on Telemedicine utilization for outcomes and cost savings. She has already worked with Dr. Kobylarz and others to line up DACH at Ft Hood in the research endeavor. She, Ms Linda Drzymalla, Ms Adrea Gulledge, Mr Walt Prescher and LTC Zeigler met yesterday to go over the new ADS v.2.0 "bubble sheet" which will add one line to the "clinical use only" section for "Telemedicine Consultation...A=yes, B=no". This will be added only to the clinics which have an active telelemedicine consultation initiative and be used for collection of data.
ACTION: (18 NOV 97) Ms Andrea Guledge (ADS/PAD) reported in an e-mail message to LTC Zeigler that Dermatology and Cardiology ADS encounter forms should have the new Telemedicine Consultation line added within ~3 weeks.
F/U: Dr Zeigler, Ms Gulledge

D. NEW BUSINESS:
1. Mr Ken Weber was introduced as the new USAISR IM chief with interest in participation in this committee. Mr Weber is welcomed as the newest member for liaison between the separate commands and budgets in matters of distance learning and telemedicine.

2. Several new initiatives have surfaced for consideration at the next meeting in January '98:

a. A distance learning classroom/center within BAMC. This concept is working its way around COL Gonzales, COL Srsic-Stor, COL McNabb, LTC Hepler, LTC Wittman, et al via ccMail.
F/U: all those listed plus Mr Dean, Ms Hamlin, and LTC Zeigler.

b. COL Gail M. Johnson, MEDEL Cmdr at JTF-B in Soto Cano, Honduras, contacted LTC Zeigler via ccMail thru COL Baskin to obtain distance learning opportunities for CME/CEU and Teleconsultation after the installation team has their units operational after the first week of December.
ACTION: E-mail contact has been maintained and LTC Zeigler provided copy to Mr Bobby Dean for further coordination.
F/U: Mr Dean and COL Johnson's LOG Officer, CPT Neri.

3. Mr Flahie and Mr Murphy reported that the VTC/T-Med equipment that was reclaimed from the closure of the US Army Hospital, Panama, is in poor condition. Parts may be scavenged for other units at BAMC.

4. Mr Flahie and LTC Dailey report that policy review will be needed since several sites, most recently Wm Beaumont AMC in El Paso, come under GPRMC but are not included in TriCare Region 6. Therefore, the billing, etc. for TeleConsultation will be a problematic issue unless agreements are negotiated between regions.
F/U: This issue will be taken to the TriCare Region 6 local office by LTC Dailey.

5. LTC Zeigler raised the issue of Store and Forward TeleConsultation and MEPRS Workload rulings. Since the consultant may not see the patient face to face, this could be problematic in obtaining a clinic "count" for clinician workload.
F/U: LTC will take the issue to BAMC RMD, LTC Hepler and Ms Gloria Paige for discussion and a ruling.

6. Meeting adjourned at 0945. Next meeting will take place on 20 January 1998, 0830-1000 in the Radiology Conference Room (NB-This room has been prescheduled for the 3rd Tuesday of every month in 1998 for these meetings).

There will not be a meeting of the VTC/T-Med WG in December, but reports on progress for the 31 DEC 97 mark on the wall should be submitted to LTC Zeigler by 16 DEC 97 (Mr Flahie, Ms Hamlin, Mr Dean, Mr Brown, Mr Murphy).

-----/s/--------
Daryl N. Zeigler
LTC, MC
Chairman
Chief, Medical Informatics and Telemedicine

Subject: Minutes of the 20 Jan 98 VTC/T-Med Working Group
Author: LTC Daryl Zeigler at MEDCEN1_FSHTX
Date: 1/26/98 10:43 AM

****** TECHNICAL NOTE: Save .xls attached files to a directory of your choice. Remember where that file is located. Open Microsoft Excel, then open the .xls file(s) in that application (project.xls shows BAMC input to date, gprmctmd.xls shows GPRMC input to date, and bamcvtc.xls is the connectivity status of NEC units at BAMC per Mr Bobby Dean. ******

Minutes of the T-Med/VTC Working Group 23 January 1998

A. The group's sixth meeting took place on 20 January 98 from 0830-0930 in the Radiology Conference Room. The group did not meet in December 1997.

B. Attendance:

1. Present
LTC Tom Wittman, C. IMD (6-4460)
Ms Vicky Hamlin, Commo Br., IMD (6-3600, 513-9410)
Mr Bobby Dean, VTC/T-Med Administrator, IMD, (6-2882, 513-1910)
Mr Ken Weber, USAIAR/IM (6-3678)
LTC Kathleen David-Bajar, Dermatology (6-4408) vice COL James A.
Keeling, C, Dermatology Department
MAJ Brian Kendall, DPALS (6-0444), vice COL Rohini Daniels, C, DPALS (6-3311)
Mr Fred Chriswell, Andries Tek, Chief Engineer (800-395-1331 or 512-453-6076)
Ms Evelyn Vergara, BAMC Internal Review (6-2009)
Ms Mary Jane Tuttle, Dept of Surgery (6-5266/513-5539)
LTC Jan Eagan, Dept of Nursing (6-4817) vice COL Dena Norton (6-1891)
COL Michael Cawthon (6-3290), Dept of Radiology vice LTC Gary Simmons, (6-4218)
LTC(P) Daryl Zeigler, Chairman (6-1924, 513-1924)

2. Absent
LTC Jean Dailey, Lead Agency Region #6 (292-3217)
Ms Gerrie Natalino, Computer Svc Br, IMD (6-3300)
Pam Clement, PhD, Dept. of Psychology (6-5779)
COL Franklin Brooks, C, Dept of Psychology (6-1600)
COL John Roscelli, C, Dept of Pediatrics (292-5097)
Mr Frank Murphy, HCSSA/SAIC (265-2090)
Mr Jim Bulgrin, Cardiology Service (6-2268)
Mr Herbert Jones, Sr., Property Book Officer, LOG (6-3132)
Mr Bob Meints, Lead Agency Region #6 (292-3240)
CPT Bill Dixon, Chief Resident, Dept. of Medicine (6-1414)
Mr Ed Ng, Nutrition Care Division (6-3372)
Mr Dwaine Brown, USAMISSA/HCSSA (265-2078)
Mr Dirck Goss, Andries Tek, Pres CEO (800-395-1331)
1LT Sandra Bruno, Patient Admin Section (6-2320)
2LT Dan Bridon, Security Officer, IMD (6-1779)
Mr Mike Flahie, ACS for IM, GPRMC (6-6042)
Ms Andrea Gulledge, PAD/ADS (6-

C. OLD BUSINESS:

1. Follow up of clinical areas.

a. All clinical connectivity issues are pending a definitive engineering test of the 21 NEC units deployed at BAMC and GPRMC. Reports indicate that these units are very questionable in their reliability since conversion from point-to-point to dial-anywhere capability with the installed v.35 card.

CONCLUSION: Unreliability of NEC units has been identified. ACTION: Ms Hamlin. Mr Dean. Mr Flahie, and Mr Chriswell will arrange for testing to take place on Wednesday, 28 Jan. Mr Chriswell will arrange with NEC to have a service technician available on Thursday 29 Jan. Mr Flahie will report the test results to LTC(P) Zeigler NLT COB (1630) Friday. 30 Jan 98.

Options:
1) NEC will implement a satisfactory repair of all units with v.35 cards.
2) If 1) fails. another vendor's codec will be installed to replace that of NEC for a trial of reliability.
3) If 2) fails. new units will have to be purchased to replace all 21 NEC units.

b. Emergency Departments BAMC and GPRMC Directed by BG Timboe. Awaiting input from BAMC EMD. F/U: COL Pfaff, LTC Sheridan
ACTION: (18 Nov 97) LTC Zeigler will seek clarification of BG Timboe's intent on this issue and will meet with the CG and COL Baskin on 16 DEC 97 in lieu of a December VTC/T-Med WG meeting.
F/U: (20 Jan 98) Dr Zeigler has the CG's clarification. A memorandum thru COL Baskin to all MTF commanders was sent through distribution and responses have begun to trickle in.
ACTION: LTC(P) Zeigler will report next meeting.

2. Follow up inventory of equipment BAMC and GPRMC.
Ms Vergara reports a nearly completed inventory. but must meet with Mr Jones to reconcile with the BAMC 100% inventory in September. She is also attempting to track down the purchase price of all VTC equipment purchased and in inventory. This information will serve as a cost of "overhead" and initial investment to determine the point of return on investment.

F/U: Lead Agent. Ms Vergara and Mr Jones
ACTION: (18 NOV 97) Still no report of total inventory or of initial $$ outlay for current inventory.
FOLLOWUP: Lead Agent. Ms Vergara and Mr Jones at January meeting.
F/U: (20 Jan 98) Ms Vergara submitted a first draft spread sheet of inventory with cost figures that are preliminary. Further refinement will be required. BAMC budget costs should be broken our from GPRMC expenditures and Lead Agent expenditures. The grand total of unit costs for BAMC and GPRMC at $6.468.670 may not be the final figure once cross checks are performed with Mr Jones. LOG/Property Book. Mr Flahie for GPRMC and LTC Dailey for Lead Agent VI.
ACTION: Ms Vergara. Mr Flahie. Mr Jones to report revised figures next meeting.

3. A distance learning classroom/VTC center is under construction within BAMC.
F/U: (20 Jan 98) all is in place. only air conditioning and room ventilation remains to be done.
ACTION: COL McNabb. LTC Wittman. Mr Dean. and Ms Hamlin.

4. Mr Flahie and LTC Dailey report that policy review will be needed since several sites. most recently Wm Beaumont AMC in El Paso. come under GPRMC but are not included in TriCare Region 6. Therefore. the billing. etc. for TeleConsultation will be a problematic issue unless agreements are negotiated between regions.
F/U: This issue will be taken to the TriCare Region 6 local office by LTC Dailey.
F/U: (20 Jan 98) No report
ACTION: Per LTC Dailey

5. LTC Zeigler raised the issue of Store and Forward TeleConsultation and MEPRS Workload rulings. Since the consultant may not see the patient face to face. this could be problematic in obtaining a clinic "count" for clinician workload.
F/U: LTC will take the issue to BAMC RMD. LTC Hepler and Ms Gloria Paige for discussion and a ruling.
F/U: Dr Zeigler has verbal understanding that the workload will count the same as a telephone consultation and must have the required documentation
of care provided.
ACTION: Ms Anrea Gulledge will assure that the ADS forms will have. in the

"For Clinic Use Only," a line for Telemedicine Consults A=yes, B=no for at
least Dermatology, Psychology, Pediatrics, and Cardiology to start with.
F/U: (20 Jan 98) No report. Report next meeting by Ms Gulledge.

6. COL Gail M. Johnson, MEDEL Cmdr at JTF-B in Soto Cano, Honduras, contacted LTC Zeigler via ccMail thru
COL Baskin to obtain distance learning opportunities for CME/CEU and Teleconsultation after the installation team
has their units operational after the first week of December.
ACTION: E-mail contact has been maintained and LTC Zeigler provided copy to Mr Bobby Dean for further
coordination.
F/U: Mr Dean and COL Johnson's LOG Officer, CPT Neri.
F/U: (20 Jan 98) Mr Dean has made contact with CPT Neri. Calls to Honduras must be placed through the Pensacola
Naval Station, Florida. The POC for placing VTC calls is Mr. Ted Hassebroch @ DSN 922-3501. Mr Dean and Mr
Hassebroch have placed a successful call @ 384 Kbps between BAMC and Pensacola. The JTF-B was having
installation of equipment the first week of Dec 97. No word on that project. ACTION: Mr Dean will recontact CPT
Neri to determine equipment status and test connectivity. Report next meeting.

D. NEW BUSINESS:

1. Mr Ken Weber listed three VTC/T-Med initiatives for ISR. (See Addendum below)

2. Dr. Zeigler reported that a VTC with several AMEDD Medical Centers and the OTSG consultant for
telemedicine, COL Sado, will take place on Thursday, 21 Jan, from 1300-1500 in the 5th floor VTC suite. This VTC
is for discussion of successful projects, impediments to full VTC/T-Med utilization and funding. LTC(P) Zeigler
will report next meeting.

3. Meeting adjourned at 0930. Next meeting will take place on 17 February 1998, 0830-1000 in the Radiology
Conference Room. (NB-This room has been prescheduled for the 3rd Tuesday of every month in 1998 for these
meetings)
-----/s/--------
Daryl N. Zeigler
LTC(P), MC
Chairman
Chief, Medical Informatics and Telemedicine

ADDENDUM
Telemedicine requirements and initiatives at the Institute Of Surgical Research and Burn Unit

Dr. Zeigler; The following initiatives are in the early development stages, but should give you and the telemedicine
team some ideas of telemedicine utilization by the ISR and Burn Team:

1. Telemedicine for burn size estimation Prospective trial comparing referring hospitals' and telemedicine
consultants' ability to judge burn size. This protocol will probably involve support from burn surgeons at other
locations as the consultants. To be submitted to Research Council for implementation in next FY.

2. Telebronchoscopy
Pilot study to establish telemedicine resources necessary to perform accurate diagnosis of the presence or absence of
smoke inhalation injury. Use of a Olympus bronchoscope system would be digitized and sent via telemedicine
capabilities. Prospective trial of ability of a telemedical consultant to accurately diagnose smoke inhalation injury on
basis of images transmitted by Burn Flight Team from referring hospitals.

3. Distance Learning
Setup an area in the Burn Unit to accommodate a telemedicine link for educational purposes on burn case studies to
other hospitals, burn research centers, and military facilities. These initiatives have not formally been sanctioned, but
are undergoing review and discussion by the clinical team. Use of existing NEC telemedicine stations for these tests
would be beneficial to explore the feasibility in these areas.   KEN

APPENDIX M

BAMC TECHNOLOGY PROFILE

Re-Engineering Laboratory (REL)

Strategic Technology Planning for the U.S. Army Medical
Department

Technology Profile

TELEMEDICINE

Process Outline
User Survey
Technology Profile

Technology Profile Process
Telemedicine

| Identify Initiatives | AMEDD C&S |

| User Survey | Initiative POC |

| Brief and Site Visit | REL Team |

| Review and Follow-up | REL Team / Initiative POC |

Market Evaluation → **Initiative Analysis**   REL Team / AMEDD C&S

REL Team
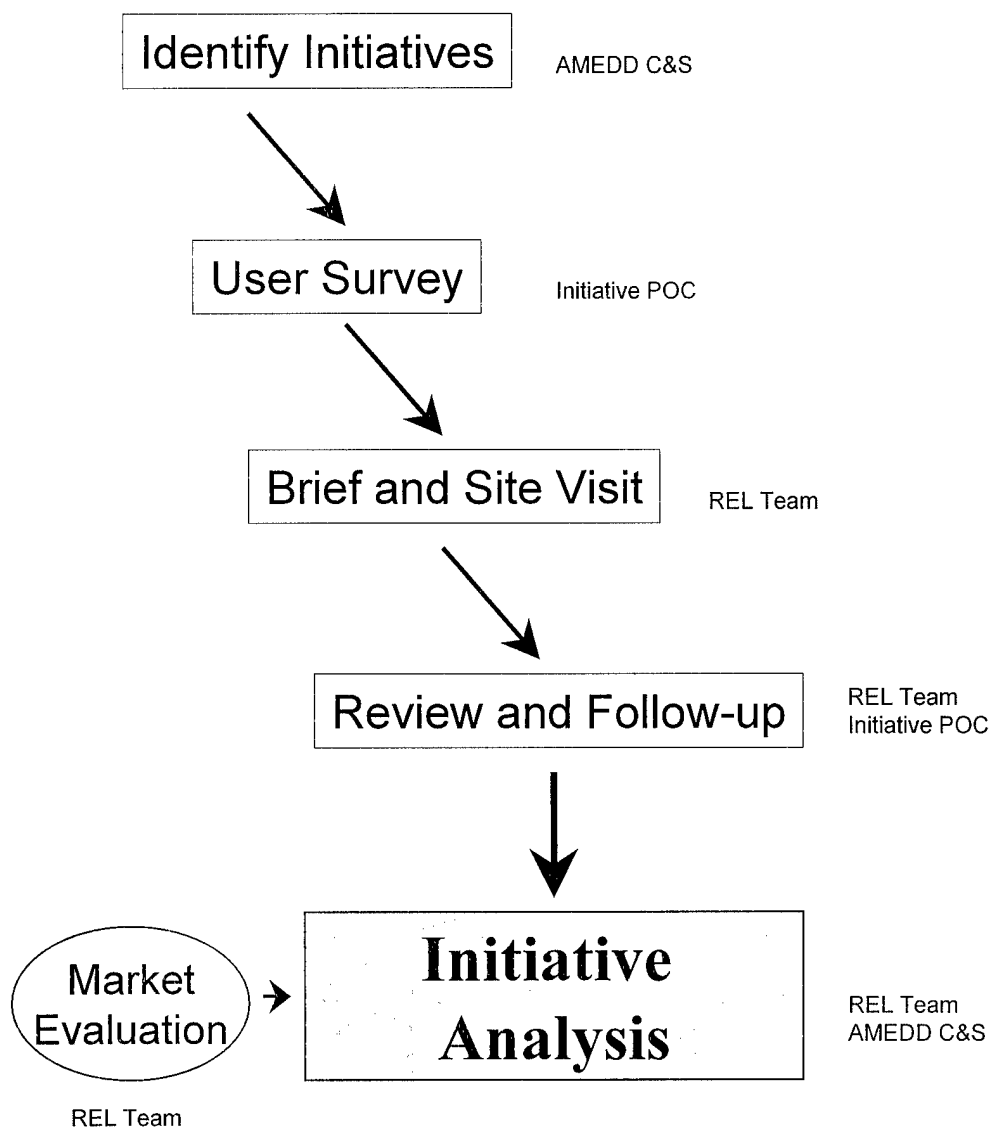
Telemedicine Initiative
User Survey
To be completed by initiative site and returned before briefing and site visit

Title of initiative: Brooke Army Medical Center Telemedicine Working Group

Point of contact:
Name: Daryl N. Zeigler, MD (LTC-P, US Army, MC)
Title: Chief, Medical Informatics and Telemedicine (MCHE-PMR)
Address: 3851 Roger Brooke Drive, Fort Sam Houston, TX 78234-6200
Telephone: (210) 916-1924
FAX: (210) 916-0598
Email: ltc_daryl_zeigler@BAMC.SMTPLINK.AMEDD.ARMY.MIL
URL:

Initiative proponent or sponsor: Same as above

Description of initiative:
describe the overall objective, current practice or approach, limitations of current practice that will be addressed by the new technology, and method for using the new technology

Information not provided

Application scenario:
provide one or more examples of use, focusing on the clinical environment, when appropriate

GME (Residency Requirements), CME (Distance learning, continuing education), True telemedicine for diagnostics, management and follow-up.

List sites at which the technology will be used:

All MTFs' throughout GPRM with BAMC as the center

Timeline of initiative:
date work started, date of first clinical use, date of full implementation, anticipated length of project

Housekeeping started in July 1997

Accomplishments to date:

100% Equipment inventory, 100% functional status

System components:

list hardware, software, networking, telecommunications requirements)

1.   NEC
2.   CLI
3.   Picture
4.   Global Med – ATT has Store & Forward software

Telemedicine Initiative
Technology Profile
To be completed by the REL Team

MISSION

	(NO USAGE LOGS)
1. Category of Technology	% time used for each

Direct clinical care:

- ❑ diagnostic   0%
- ❑ therapeutic   0%
- ❑ preventive   0%

Non-clinical use:

- ❑ administrative   0%
- ❑ education/training   0%
- ❑ health promotion   0%
- ❑ logistical   _____
- ❑ marketing/improve morale   _____

2. Application Environment

Combat casualty care
- ❑ reduce battlespace deaths(KIA)   _____
- ❑ reduce evacuations   _____
- ❑ reduce combat stress   _____

Keep AD forces on job
- ❑ disease management (DNBI) (deployed)   _____
- ❑ disease management (DNBI) (sustaining base)   _____

- ❑ Preventive (deployed)   _____
- ❑ Preventive (sustaining base)   0%
- ❑ Humanitarian assistance (non-DOD beneficiary)   _____
- ❑ Sustaining base (beneficiary care)   0%
- ❑ Reduce MHSS skill mix and staffing   0%
- ❑ Reduce health service requirements of TRICARE support contractors   _____
- ❑ Keep beneficiaries at work or home   0%

3. End User

- ❏ Individual
  - ❏ Combat arms   _____
  - ❏ Combat service support   _____
- ❏ Unit (Echelon 1-2)   _____
- ❏ Unit (Echelon 3-4)   _____
- ❏ Sustaining base (Echelon 5, CONUS)   _0%_

4. Role of AMEDD in this initiative

- ❏ Researcher

  determines fundamental knowledge related to the scientific or engineering field being investigated

- ❏ Developer

  solves technical and engineering problems related to the production of the finished product

- ❏ Systems Integrator

  combines products from multiple sources intoa unique product, may add proprietary hardware or software to system

- ❏ Evaluator

  conducts or participates in clinical or technical trials, including usability testing

- ❏ Advisor

  provides clinical, military, or technical expertise to developers

- ❏ None

5. Initiative Driver

- ❏ Investigator-initiated (investigator academic or clinical interests)
- ❏ Centrally directed (USAMRMC, DOD-HA, AMEDD C&S, etc.)

6. How is access to the initiative determined?

What patients and providers participate? How are they selected?

Follows customary referral paterns (PCM⇆ Specialists)

7. Customer base

number of users	_____
number of units/devices	_20+_
number of uses per time unit	_____
number of units in use now	_?_
total number of units needed	_____

8. Market penetration

Uses of the technology/total incidence or number of uses

one year ago	_?_
today	_____
one year from now (estimated)	_____

MATURITY

9. Technology Sources
list all that apply

Non-developmental item

- ❑ commercial off-the-shelf (COTS)
- ❑ government of-the-shelf (GOTS)

Developmental

- ❑ enhanced (customized) GOTS/COTS
- ❑ custom ("one-off," finished product)
- ❑ prototype (as a phase of development)

10. Integration with existing IM/IS infrastructure

- ❑ Yes
  - ❑ full functionality
  - ❑ demonstration mode only
- ❑ No

11. Anticipated time to mainstream acceptance and use

- ❑ Today (1997-2000)
- ❑ Transition (2000-2007)
- ❑ Force XXI (2007-2017)
- ❑ Army After Next (2017-2025)
- ❑ Army of the future (beyond 2025)

12. Barriers to entry

- ❑ development cost
- ❑ unit cost
- ❑ complexity
- ❑ physician/provider resistance
- ❑ patient resistance
- ❑ immature technology
- ❑ competing product or practice

13. FDA regulatory status

- ❑ None
- ❑ Under review
  - ❑ 501k
  - ❑ PMA
- ❑ Approved

PERFORMANCE

14. Describe the system components (see attached sheets)
model, peripherals, software version, weight/cube, power requirements, MILSPEC, etc.

Hardware: CLI Radiance, document camera, NEC, no peripherals, Picture Tel, no peripherals

Software: Global Med – system, House Call – custom software

Networking: ISDN, Video-conerencing, Frame-relay & packet switching (provided by MedNet)

Telecommunications:
Primary Video Conferencing with some Telemedicine and Teleradiology

15. What data fields are : Information not provided
acquired:
transmitted:
archived:

16. How is data transmitted? ISDN

17. What are the bandwidth requirements? From 112Kbs to 1536Kbs, application dependent

18. What data standards are currently used? Packet switching & Fame relay
(e.g., HL7, DICOM, TCP/IP, H32x)

19. What is the system load ?   Varies
(frequency of use, time per use)

20. How is integration with existing IM/IS resources achieved? Use of MedNet, shared personnel with BAMC

21. Is the system used in a clinical evaluation process? NO

22. Is the process approved by a duly constituted institutional review board? NO

RELIABILITY

23. What is the reliability level?
number of times use is successful/number of times use attempted

One example is Telepsychology, 12 attempts-no success

24. What are the service requirements? Cross platform incompatibility and audio but no video a problem
routine:
unscheduled:

25. What personnel are allocated to
system administration: One FTE Contractor, One GS11@ ½ time, One Army LTC(p),
  Medical Corps (full time Physician)
technical service support: Vendor contracted

26. In what environments is the system designed to operate?
In Hospital setting

27. In what field environments has the system been tested?
None

28. What training is required before using the system?
5th Floor & Downstairs VTC Room – first couple times user is trained to set-up and operate independently.

APPENDIX N

DACH TELEMEDICINE BUSINESS PLAN

DARNALL

COMMUNITY HOSPITAL

FORT HOOD, TEXAS

TELEMEDICINE
BUSINESS PLAN

Table of Contents

Mission

Fort Hood Medical Activity (MEDDAC) with its military, civilian, and volunteer personnel, operates an integrated health care system providing clinical and preventive services in support of, and responsive to, the largest military installation in the Department of Defense. We educate and train medical personnel to a continual state of readiness.

Darnall Army Community Hospital (herein referred as Darnall) is composed of a staff of over 1,700 health professionals, dedicated to providing high quality medical care who perform almost one million outpatient visits annually. Darnall has a substantial interest in the Central Texas Region with the responsibility of providing the best possible health care services to over 40,000 active duty military members and their more than 70,000 family members. Darnall has twelve Troop Medical Clinics (TMC's) located on Fort Hood for treatment of active duty soldiers, and three off-post health care clinics which provide medical care in a family practice setting.

Vision

Over the last three years, Darnall has propelled itself into the prominent role of being recognized as a leader in telemedicine within the U.S. Army Medical Department. Our objective at Darnall is to continue in the pursuit of the "HOSPITAL WITHOUT WALLS" concept. Opportunities abound by utilizing tele-consultation to conduct a broad spectrum of clinical encounters without the simultaneous physical presence of both provider and patient in the same place. Telemedicine-consultation will provide medical center expertise to the beneficiaries of Fort Hood as though a medical center was located here. Via telemedicine a provider elsewhere "sees" the patient at Darnall when the expertise is not available locally. Individual objectives are listed in the "Objectives and "Capital Requirements" sections.

Background:

In October 1994, a strategic planning conference was held with key staff members of Darnall and Brooke Army Medical Center (BAMC). At that time BG Claypool presented his vision of creating a "hospital without walls" that would be connected through telemedicine to create a seamless health care facility. This concept was immediately seized by the leadership of Darnall, culminating in a proposal to develop an IDNX/digital switching network. The network would operate on a T-1 backbone and employ either PictureTEL or CLI TVCs (based on application).

Simultaneously, BAMC consulted with various vendors and visited Texas Tech University. Ultimately it was decided to employ seven point-to-point T-1 lines between Darnall and BAMC that could be manually switched if the need arose to talk to someone other than the person you were hardwired to. Twenty customized NEC TVC carts, approximately 6.5 feet tall with dual monitors were procured, ten for each site. This system was operational from April 1995 to March 1996 with 51 drops located throughout Darnall and 29 drops throughout BAMC from which telemedicine or teleconferencing could be conducted. This system was phased out in April 1996 when BAMC moved to their new facility.

Darnall's intent was to become the vanguard of Information technology in Great Plains Regional Medical Command. With a growing beneficiary population due to the Army's execution of the Base Realignment and Closure Act (BRAC), this already taxed MEDDAC made the decision to leverage technology through the deployment of telemedicine.

Progress proceeded by maintaining a global perspective on the benefits and potential of telemedicine while maintaining a pulse on the opportunities available in the Central Texas Region. This perspective led to the development of a myriad of projects which today are at various stages of completion.

Now we are at a point to look beyond the "background" and transcend to the future through the utilization of telemedicine to create a virtual "HOSPITAL WITHOUT WALLS". A more in-depth description is contained in the following, "Objectives" and "Capital Requirements" sections.

Objectives:

The ten objectives of the Darnall telemedicine program are:

1. Darnall / Texas A&M GME Conference System
2. Leadership Video Conferencing System
3. Satellite C-Phone Interface
4. Family Care Clinic Remote Diagnostic System
5. Digitized Telephone Switch
6. Personal Communication Network
7. Teleradiology
8. Telepathology
9. Advanced Warfighting Exercise (AWE)
10. NOD-Wilford Hall-BAMC Connectivity

1. <u>Darnall / Texas A&M GME Conference System</u>: In May, 1996 Darnall connected via a T-1 line to Texas A&M University's Health Science Center (HSC). Darnall's affiliation with Texas A&M University is in support of the Psychiatry Department Graduate Medical Education. The connection to Texas A&M is connected directly to the Trans Texas Video Network (TTVN). The TTVN has allowed Darnall to gain access to the Texas A&M network which is connected to over 80 educational, research, and medical facilities throughout the state. Future plans call for a connection into our Deputy Commander for Clinical Service (DCCS) Conference Room and the purchase of a V-TEL conferencing unit. Once fielded, the access offered by the TTVN will be taken advantage of to the maximum extent.

2. <u>Leadership Video Conferencing System</u>: A desktop video conference system (C-Phone) has just been installed. Desk-top video conferencing is a means for two or more personnel to be audio/visually connected through their existing computer monitors. C-Phone will complement teleconsultation-consultation. This system will allow a limited number of key hospital personnel to conduct video conferencing, attend meetings via remote, or report on important events to the hospital commander or chief of staff. C-Phone is currently connected to administrative division chiefs and future plans are to connect the clinical chiefs.

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Upon completion it will give us the ability to conduct video conferencing utilizing both desktop and group oriented video conference systems.

3. Satellite C-Phone Interface:

Fielding of C-Phone devices to satellite buildings will reduce the time key personnel are away from their desks or area of responsibility. As a cost effective means of reducing travel time, C-Phone will be installed in Managed Care Division (Building 36019); Department of Readiness, Education, Training, and Education (DRETS); and Personnel Division (Building 36001). Additionally a "proof-of concept" of connecting C-Phone to our three down-town clinics will be tested.

4. Family Care Clinic Remote Diagnostic System:

   a. A myriad of services are envisioned for the following three clinics: The Adult Chronic Care Clinic (AC3), Killeen Family Care Clinic (K-FCC), and Copperas Cove Family Care Clinic (CC-FCC). Recently a T-1 was installed between the AC3 and Darnall. This is being utilized as a "backbone" for: point-to-point telemedicine between our Chief of Department of Medicine and the AC3 Chief, CHCS, and for the pending installation of the Integrated Financial Control System (IFICS). Telemedicine will be conducted over a CLI TVC provided by MEDCOM.

   b. Telemedicine is also planned at K-FCC and CC-FCC. In an effort to contain cost and maximize existing resources, NEC carts purchased by BAMC for the initial Darnall-BAMC project will be utilized. Currently we are in a "proof-of-concept" test utilizing a NEC at each clinic connected through a WAN server to see if it can successfully transmit through a C-Phone. Additionally, Darnall is looking at ways of minimizing the transfer of hard copy information by courier between three clinics and the main hospital. For example, an Elmo EV-X film-to-video converter is being reviewed that would allow the transmission of a digitized image to our Radiology Department where it would be read instantaneously and the results electronically transmitted to the provider. Clear, tangible benefits would be derived from such a system: reduction of courier service, minimized risk of loss data, faster diagnostic treatment by the provider, all to the benefit of the patient.

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5. Digitized Telephone Switch:

The hospital switch is now filled to capacity with respect to trunks (common user access into and out of the hospital), so adding more without an upgrade is not an option. We are also the only Command on Fort Hood that is not capable of Integrated Services Digital Network (ISDN). We are currently looking at upgrading this aging SL-1 telephone switch with ISDN capability and additional trunking to handle the increased calling population. Our proposal is to go with an Option 81 switching system equipped with 1800 voice lines and ISDN, using entirely digital telephone sets. The existing automated attendant and voice mail system would be incorporated into the upgrade switch.

6. Personal Communication Network:

a. A wireless phone system is to be provided to key hospital personnel. A wireless phone has many advantages over a cellular phone and thus eliminates the need for cellular phones and beepers/pagers normally associated with working in the hospital environment. A wireless phone system differs in:

1. No air time charges. It interfaces with the host telephone system to process and manage telephone traffic.

2. No static, fading, or dead zones. The signal is carried from one base station than handed to another.

3. No eaves dropping by tuning into the call. It also has the same features as you office telephone, in fact they can share the same number. Caller ID, call forward, conference, and voice mail with message waiting indication are all features available on a wireless phone.

4. No running out of power. Most will operate 8 - 10 hours on a single battery charge verse 4-6 on most cellular phones.

b. By employing wireless telephones will expect to improve coordination throughout the staff and develop a faster response time to situations as they arise. It will also allow instant access to information which should result in fewer errors and streamline operations by freeing up additional time required to find a phone to answer pages, etc. The goal is to call a person and not a place, to have one-phone and one-phone number for the duration of an assignment at Darnall.

7. Teleradiology:

A film-less radiology system is being planned by Darnall. A MEDCASE is submitted for a FUGI Computed Radiography AC-3CS System for digital radiography pictures. It will complement teleradiology-consultation by allowing practitioners to examine patients at the Troop Medical Clinic (TMC), then forwarding rapidly displayed images to diagnostic workstations at the Radiology Clinic at the hospital. Once at the hospital they will be interpreted and transmitted back to the TMC. It replaces film and screens. It will also save precious man-hours by preventing travel by the soldier to the hospital and the subsequent delays in awaiting interpretation of results. It will also allow soldiers to remain with their unit, where they are most needed.

8. Telepathology:

Darnall has the capability of transmitting or receiving pathology lab images to the Armed Forces Institute of Pathology. This is accomplished with a Roche imaging system over twin 56Kbs lines. However, utilizing 56Kbs lines results in a very slow download time for images. Darnall envisions sending tissue results or receiving results from a consortium of medical facilities. This would be accomplished with an IDNX/Teleos network over a T-1 line, thereby greatly speeding the image transmission. This will enable each facility to draw upon the vast expertise at other commands, and would be available to any site with a digital telepathology system utilizing industry H.320 Standards.

9. Advance Warfighting Experiment (AWE):

Darnall will provide Level V teleconsulation support of the 97-02 Task Force XXI AWE. The AWE is scheduled for March, 1997 at Fort Irwin, California and is in support of the Experimental Force (EXFOR) of the 4th Infantry Division (Mechanized). Currently we are coordinating with C Company, 4th FSB who use a satellite based telemedicine system verse Darnall's T-1 land-based system.

10. NOD - Darnall - Wilford Hall - BAMC - Region 6 Teleconsultation:

   a. Darnall is connected to the Great Plains Regional Medical Center via a standard 56 Kbs line using a PictureTEL TVC. This system will be used for both

leadership training by the GPHSSA and in the overall management of TRICARE.

b. Prior to BAMC moving to their new location, we had experienced successful medical interaction between ten (10) of our clinics and their counterparts at BAMC utilizing NEC TVCs. During BAMC's transition to the new hospital we currently have a direct T-1 connection from our DERM Clinic to their DERM Clinic. We also have connectivity to the Wilford Hall NICU from our NICU via a dedicated T-1.

c. Darnall's plan is to link the main hospital (Building 36000) to both Wilford Hall and BAMC. This will be made possible by employing a Teleos 200 switch, IDNX 90 multiplexer and a DS-3 data line through the Network Operations and Deployment (NOD) Center. The NOD uses a multi-point control unit as their gateway to other medical facilities. Connecting these facilities will allow divergent facilities with divergent staff to optimally work together, thereby increasing access to health care while decreasing costs. This new system will further the "hospital without walls" concept.

All of these initiatives will be diligently persued with the overall objective of improving the health of our beneficiaries.

Capital Requirements:

To implement our plans we require an investment totaling 1.214 million dollars for the following purposes:

1. Darnall / Texas A&M GME Conferencing System = 85K

    a. 85K. Provide additional VTEL conferencing equipment to our DCCS Conference Room.

    b. 10K. Wiring infrastructure.

2. Leadership Video Conferencing System = 45K

    a. 30K. Provide desktop video conferencing capabilities to 8 additional locations within the immediate area of the hospital.

    b. 15K. Wiring infrastructure and additional multi-point control unit.

3. Satellite C-Phone Interface = 97K

    a. 47K. Engineer and install an interface of our C-Phone system into the projected TELEOS/IDNX telemedicine network.

    b. 30K. Provide desktop video conferencing capabilities to 3 additional locations.

    c. 20K. Wiring infrastructure.

4. Family Care Clinic Remote Diagnostic System = 37K

    a. 15K. T-1 Installation to K-FCC and CC-FCC.

    b. 7K. Two additional desktop video conferencing units.

    c. 5K. Radiology film-to-video converter.

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d. 10K. File server.

5. <u>Digitized Telephone Switch</u> = 722K

    a. 722K. Hardware upgrade to Option 81 and software upgrade from release 19 to 20. 2,000 lines with ISDN equipment.

6. <u>Personal Communication Network</u> = 107K

    a. 107K. Wireless phone system, base station, engineering analysis, 500 telephones, installation, warranty.

7. <u>Teleradiology</u> = Researching cost at this time.

8. <u>Telepathology</u> = 10K

    a. 10K. T-1 Line and infrastructure.

9. <u>Advanced Warfighting Exercise(AWE)</u> = 10K

    a. 5K. Fairchild RF Modem.

    b. 5K. AppleTalk Router.

10. <u>NOD-Wilford Hall-BAMC Teleconsultation</u> = 111K

    a. 137K. Teleos 200 Digitized Switch.

Customer/Patient Profile

In the medical field, it has been common practice for health care providers to seek additional consultative expertise, refer patients to other locations, and send supporting treatment information (medical records, x-rays, lab images etc) via local and long distance postal services, military runners or dispatchers. Virtually all of our customer/patients will derive benefit from telemedicine by transporting medical information (rather than paper) to the soldier rather than bringing the soldier to the information.

Darnall patients include active duty military personnel, reserve military personnel, retired military personnel, and dependents of eligible military personnel. DACH has the responsibility of providing the best possible health care services to over 40,000 active duty military members and their more than 70,000 dependants. Darnall's patients range in age from the newborn to the aged. They come from surrounding communities throughout Central Texas.

Marketing Plan

Responses from users of our existing telemedicine systems and video conferencing systems indicate that the service is enjoying an excellent reputation and we fully intend to continue this trend. Relationships with Texas A&M, Scott & White Hospital, Olin Teague Veterans Hospital, in conjunction with our military affiliations, substantiate the fitness of Darnall Army Community Hospital for considerable growth and accomplishment in the telemedicine arena.

Darnall Army Community Hospital's strategy is to aggressively enhance, promote and support the fact that our customers are our priority and we must utilize technology (of which telemedicine is showcased) as it becomes available to maintain our position as the leading health care provider in Central Texas.

Conclusion

The "state-of-the-art" technology being employed in the form of telemedicine throughout the world is creating a paradigm shift in health care. Today, telemedicine touches every corner of our organizationm from our day-to-day business practices of sharing information between clinics to performing life saving neonatal procedures. These efforts are an important step forward in producing a seamless network of patient care among Darnall and its military and civilian affiliates. As our active duty population decreases it is important to keep our soldiers on the job. Our goal is to move information instead of people.

DoD Health Services Region VI
Telemedicine Pilot Project

Concept: A video-teleconferencing based network for DoD Region VI to support the development and delivery of health care over long-distance, integrating all aspects of telemedicine into a single regionally based communications infrastructure. The TRICARE Southwest Telemedicine Pilot Project is an approved DoD (Health Affairs) MHSS Proponent Committee, Proof-of-Concept project in Teleconsultation initiated within DoD Region VI to evaluate the concept of utilizing video-teleconferencing (VTC) to support the delivery of health care over long-distance by providing medical expertise to underserved military treatment facilities within the region.

DoD Region VI covers Oklahoma, Arkansas, and major portions of Texas (defined as Eastern Texas) and Louisiana (defined as Western Louisiana). DoD Region VI was geographically configured around two military medical centers to ensure regional access to tertiary care: Wilford Hall Medical Center (WHMC) and Brooke Army Medical Center (BAMC), to provide health care to a beneficiary population of around one million. WHMC functions as the Lead Agent and focal point for health services planning within the region.

The region includes a mixture of Army, Air Force, Navy and USTF medical facilities. Army MTFs include one Army Medical Center, and three Army Hospitals. Air Force medical assets include one Air Force Medical Center, eight Air Force Hospitals and five Air Force Clinics. One Navy Hospital and three Branch Clinics are also located in the Region.

Objective: The purpose of this project is to introduce telemedicine technology into daily practice and training for providers n Region VI. To this end, the project will evaluate Telemedicine as the vehicle for improving the regional referral process. The goals of the TRICARE Southwest Telemedicine Pilot Project are:

     (1) improve access and quality at rural bases,
     (2) increase beneficiary and provider satisfaction with health care delivery,
     (3) prepare providers for support of deployed forces via teleconsulting,
     (4) improve and integrate the regional MTF referral process and facilitate cross service referrals
     (5) be cost-effective or cost-neutral.

Discussion: Telemedicine uses an interactive video system integrated with biomedical telemetry. It allows a physician at a specialty medical complex or teaching hospital to examine and treat patients at multiple satellite locations such as rural hospitals and clinics. Integrated into the video system, and based on the requirements of the remote medical facility, are a number of diagnostic devices. The remotely controlled examination camera has a powerful zoom-focus capability that allows a dermatologist to examine small details of a patient's skin. An electronic stethoscope permits a cardiologist to do a complete cardiological examination. Specific camera adapters and resolution capabilities enhanced by remote controlled optics provides an ophthalmologist a clear view of the retina of a patient at the referring site. A specialist can review any type of X-ray examination including an MRI, CAT scan or ultrasound.

Specialists at the medical center can evaluate patients at the same time as primary care physicians, who receive interactive educational input. The educational level of primary care physicians is improved, enabling them to handle more complex problems and effect more appropriate utilization of specialists. This is a concept which complements the primary care management concept of TRICARE. The telemedicine system, by reducing the need to transfer a patient, maintains continuity of care between the patient and the primary care physician. If a patient does need to be transferred, the primary care physician can be updated daily over the telemedicine link. Once the patient is discharged from the referral facility, the specialist's follow-up care of the patient also is facilitated by using the system, without the inconvenience of distant travel by the patient.

A telemedicine system thus provides immediate access to quality healthcare. It resolves the problems inherent in our existing system of: geographic or socioeconomic isolation for the patient; professional isolation for the provider; escalating costs; inappropriate utilization; loss of continuity; and ineffective CME.

A telemedicine system must provide a complete set of clinical information about a patient to the physician/specialist in real time. This not only involves information sent from the clinical setting to the physician's workstation but also requires that the physician be able to access information about the patient's current and past medical condition in a time and space independent manner.

The high speed and dynamic flexibility of the selected communication protocols (OC-3, DS3, T1, bandwidth-on-demand technology (ATM), and DICOM standard for medical information interchange) support the necessary mix of multimedia information in a unified and clinically useful manner. Live teleconferencing, requiring moderate bandwidths on a continuous basis, is integrated with patient vital signs (low bandwidth data, bursty and continuous to provide the physician with a "telepresence" to the patient.

Telemedicine offer benefits to key stakeholders in the health care system: (1) Patients benefit from improved access to specialty care; reduced transportation and hospitalization costs as well as decreased stress associated with traveling long distances to a specialty care facility; increased continuity of care as a result of remaining at the primary care provider's facility; increased quality of care through specialist consultation and immediate attention to potentially life-threatening conditions, (2) Providers experience reduced professional isolation: improved continuing medical education through such applications as distance learning and videoconferencing, and (3) Health Care Facilities benefit from improved ability to attract and retain highly qualified health care professionals; and increased market share as well as improved efficiency by virtue of the ability to provide a full spectrum of services.

Telemedicine Opportunities: Telemedicine opportunities can be broken down into two broad categories: Doctor-to-Doctor or Doctor-to-Patient.

Doctor-to-Doctor includes transmission of medical records, transmission of medical images, video consultations, continuing medical education, teleradiology/telecardiology/telepathology, multimedia, electronic data interchange, rules-based messaging.

Doctor-to-Patient includes remote patient monitoring, delivery of health information, video consultations.

Project Proposal Description: The long term vision of the Telemedicine Project will be to integrate the initiatives in teleradiology, teledentistry, tele-education, telepathology, and teleconsultation (both peacetime and contingency support) into one regionally integrated network. These components of telemedicine can all use the same communication infrastructure. This communication network must be capable of handling the transmission bandwidth requirements of teleconsulting, teleradiology, telepathology, and video-teleconferencing. The requirements for bandwidth range from low to high on a continuous basis and sometimes in bursts for some applications (image and data exchange). The technical task force, in collaboration with AT&T through the Defense Commercial Telecommunications Network (DCTN) contract, will refine these communications requirements and develop the communication infrastructure as part of the final telemedicine plan.

The plan is to have this network organized to function as a comprehensive system for the whole region, creating a "virtual health care delivery system". It will incorporate new technologies such as digital compression, store and forward, automated medical record, video EMAIL, and computers. It should improve subspecialty consultation, decrease costs, and inspire physician education.

Project Development Approach: The project was developed and requirements determined by a task force approach (a clinical task force, an administrative task force and a technical task force) in a collaborative environment between Services. An executive task force provided oversight and integration of the three task

forces, which was co-chaired by the Executive Director and Medical Director of TRICARE Southwest. The task forces included providers, administrators, and technicians from Wilford Hall Medical Center, Brooke Army Medical Center, AFMSA, SCHSSA, and San Antonio Clinics.

The clinical task force's goal was to develop the clinical requirements for the project. A trial was conducted by this task force utilizing the four leading vendors in telemedicine VTC group systems: PTel, CLI, NEC, and VTEL. Desktop systems from TRW and the previously mentioned vendors were evaluated during the two week trial between WHMC and BAMC. The purpose of the trial was two fold: First to determine transmission speeds needed for the various specialties and which applications are clinically appropriate for teleconsulting, and second, which of the various functionality's are needed for the Pilot Phase of our project. The clinical task force also determined the requirements for diagnostic devices required for teleconsultations. The technical task force and the contractor (AT&T) will take the requirements developed by the clinical task force and turn them into technical requirements for the telemedicine system.
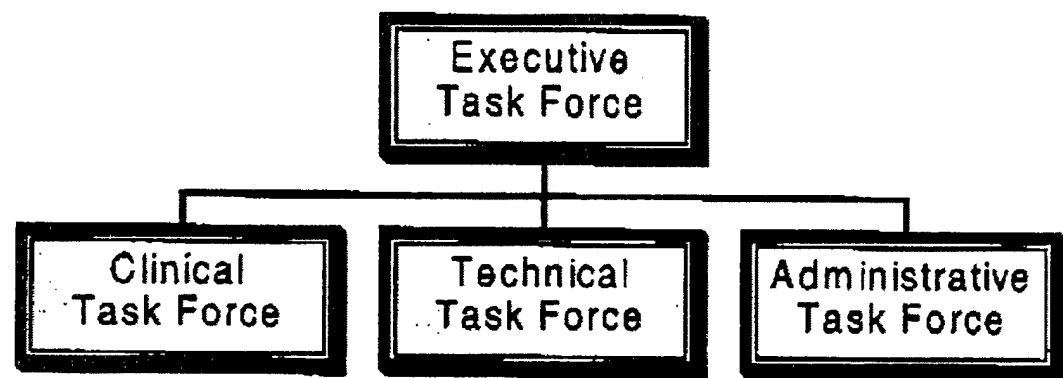
AT&T took into consideration any additional requirements driven by teleradiology, tele-education, teledentistry and telepathology. They integrated, where feasible, the requirements and develop the recommended communication infrastructure and hardware requirements for the entire telemedicine system. The administrative task force was responsible for the establishment of policies and procedures for the project. This includes, but was not limited to, scheduling, medical record documentation, cost/benefit analysis (CBA) plan, project evaluation criteria, manpower support requirements, and system administration.

Issues Addressed During Project Development: The following were some of the issues addressed prior to project implementation. This list is not meant to be all inclusive nor in order of importance or chronological order.

Develop evaluation criteria for the project (what are they?)
Determine MTF system configurations in collaboration with MTF providers and staff
Develop CBA Plan and Model
Integrate telemedicine project with outreach managed care project (C-21 Managed Care Outreach
        Program - Flying physicians to remote MTFs for consultations)
Determine manpower requirements for technical support
Develop referral guidelines and procedures
Determine procedures for scheduling teleconsultations
Determine medical records documentation procedures
Determine medical/legal implications (e.g., informed consent)

Project Evaluation: The project's objective is to determine how and to what extent the use of telemedicine applications affect access, quality, and costs in providing specialty healthcare services to remote locations throughout the region. The administrative task force developed the evaluation criteria to be utilized for the pilot phase of the project with input from the technical and clinical task force. The project includes evaluation of the following key areas: user satisfaction, cost-benefit, impact on access to care, and organization and management. The evaluation criteria includes:

(1) Assessing patient and provider satisfaction with telemedicine consultative and technological services.

(2) Evaluating the extent to which telemedicine improves diagnostic accuracy and treatment effectiveness.

(3) Determining the impact of telemedicine on rural beneficiaries and provider access to specialty services.

(4) Comparing costs of utilizing telemedicine approaches to rural healthcare delivery with traditional methods of meeting rural patients' specialty needs.

The Cost-Benefit Analysis (CBA) Plan was accomplished by a U.S. Army-Baylor Resident, as his ~~Graduate Management Project for successful~~ completion of the requirements for a Graduate Degree in Healthcare Administration (MHA). The CBA will be accomplished from October 1996 - September 1997 with a final report produced by the end of calendar year 1997. The CBA Plan has been accomplished which outlines the data collection procedures during the pilot period and also displays the baseline data collected for comparison in the CBA report. The baseline data was collected using FY 1995 as the base period. The CBA Plan shows the potential for payback of the initial capital investment within three years. The CBA report will determine the overall cost-benefit of this technology and specifically answer the question of cost-effectiveness.

Communication Infrastructure: The communication infrastructure needs to be capable of handling the requirements for high speed, bandwidth-on-demand to support all the telemedicine functionalities mentioned in the proposal. We are currently working with the Defense Information Systems Agency (DISA), the Army MEDCOM Health Care System Support Activity (HCSSA), and the Triservice Infrastructure Management Program Office (TIMPO) to develop, procure, and fund this comprehensive communications infrastructure.

Project Implementation: The Region VI Telemedicine Project implementation will be phased in over 1-2 years to ensure the smooth transition from current practices to this new advanced technology application. The first phase will be a demonstration test bed for teleconsultation and teleradiology on a small scale. This will enable us to evaluate the cost effectiveness of the project prior to full regional implementation. Furthermore, this will allow us to evaluate the administrative procedures and technological applications on a much smaller scale and make the improvements necessary prior to partial and full implementation of telemedicine throughout the Region.

Phase I: Pilot Project

Teleconsultation: The Pilot Phase consists of an evaluation period lasting six months to a year and includes the following military treatment facilities (MTF): Corpus Christi Naval Hospital, Corpus Christi, TX; Goodfellow Clinic, San Angelo, TX; Dyess Hospital, Abilene, TX; Ft Polk Hospital, Leesville, LA; and Laughlin Hospital, Del Rio, TX. The test will utilize both of the medical centers in the Region: Brooke Army Medical Center (BAMC), and Wilford Hall Medical Center (WHMC), San Antonio, TX as the referral facilities.

Goodfellow Clinic currently refers over 50 beneficiaries a month to the San Antonio Service Area (SASA). The worksheet below is a breakdown of the referrals by facility and specialty.

Laughlin Hospital currently refers over 75 beneficiaries a month to the San Antonio Service Area (SASA). The worksheet below is a breakdown of the referrals by facility and specialty.

Corpus Christi Naval Hospital currently refers over 50 beneficiaries a month to the San Antonio Service Area (SASA). The worksheet below is a breakdown of the referrals by facility and specialty.

Ft Polk (Bayne-Jones Army Community Hospital) currently refers over 25 beneficiaries a month to the San Antonio Service Area (SASA). Ft Polk also receives some of their specialty consultations from BAMC providers at Bayne-Jones, so therefore the actual number of specialty visits is higher.

Dyess refers over 26 beneficiaries a month to the San Antonio Service Area (SASA) and over 20 a month to Sheppard AFB.

Teleradiology: An MDIS teleradiology small spoke system has already been funded and purchased for Vance Clinic and a large spoke for Dyess Hospital. The following MTFs are scheduled to be installed with spoke systems in FY 97: Goodfellow, Laughlin, and Altus AFB. Therefore the Pilot Phase will include a small demonstration of MDIS utilizing the referral capabilities of WHMC and BAMC. The teleradiology systems will integrate into the same telecommunications infrastructure used by the teleconsulting systems. This integration will capitalize on economies-of-scale and sharing of unused capability, thereby increasing the potential of these telemedicine systems cost-effectiveness by reducing duplication of communications infrastructures.

Telepathology: Armed Forces Institute of Pathology (AFIP) has developed a telepathology system utilizing Roche Imaging Systems digital equipment and Olympus microscopes and cameras. These systems will facilitate the review by pathologists at WHMC, BAMC, and AFIP for more difficult cases. The MTFs that are appropriate for this technology are WHMC, BAMC, Corpus Christi, Ft Hood, Sheppard, Ft Sill, and Ft Polk. Currently the Roche system utilizes POTS (Plain Old Telephone System) and at a later date when the system is upgraded for T1 network utilization, will be added to the Telemedicine Network.

Based upon the MTF and Specialty Participation Selection Criteria (developed by the Clinical Task Force) the above MTFs were selected for the Pilot Phase of the Telemedicine Project. Furthermore, based upon the referral patterns already existing between the referring MTFs and the two Medical Centers and the volume of such referrals, specialties tentatively selected were ENT/Ophthalmology, Orthopedics, Dermatology, Cardiology, Pathology, and Special Pediatrics. Additional specialties were targeted based upon their interest and the existence of the central Telemedicine Suite for utilization by all interested specialties. This allows us to test several different specialties at the two Medical Centers and includes the Joint Dermatology Residency Training Program between WHMC and BAMC.

System Configuration:

The trial mentioned earlier yielded resounding support for the CLI VTC products in collaboration with AT&T Telemedicine solutions. System configuration was ultimately driven by the functional users (providers) at each MTF in the Pilot Project. A combination of approaches are utilized including a roll-about, portable configuration and development of permanent Telemedicine suites for teleconsulting. The number and specific requirements will be driven by specialty participation and needs of referring physicians in the remote MTFs.

Systems will include interactive quality video and audio, store and forward graphics capability, video E-Mail, on-line medical record documentation and data exchange, document cameras (consultative x-ray quality images), patient cameras, and other medical peripherals such as: ENT videoscope packages, digital stethoscopes, ophthalmoscopes, high resolution monitors, fundus camera, and slit lamp systems.

Remote Facility Systems (Patient Node): The Patient Node consists of a full Teleconsultation Workstation which includes: CLI Radiance VTC Systems with Dual 27" Monitors; Pentium based under-the-counter PC with an over-sized monitor, El Touch-Screen technology; MDTV "Housecoat" software for the creation of an electronic medical folder for store-and-forward, non-interactive consults, and three cameras - a single-chip room camera, single-chip document camera, and a scope camera which interfaces with the medical peripherals. The PC Workstation includes a Full-Motion Capture Card, Laser Printer and Text Scanner.

Medical Center Systems (Consultant Node): The Consultant Node consists of the same equipment, but without the scope camera and associated medical peripherals. The consultant node is capable of selecting all three patient node cameras and manipulating the room and patient cameras. It is also able to capture or import images and annotate them by markup, keyboard text or audio recording. The resulting image and annotation is stored as part of the particular consultation within the software's database.

Each Medical Center will have a central Telemedicine Suite including the following equipment: Pentium PC (listed above), CLI Radiance Model 8875 Dual 27" Monitor Video System, RS449 User Data Port, Supercam Document Camera, VHS VCR, T1 RS449 Interface with CTX and CTX Plus.

The systems in the seven specialty clinics will provide store and forward, non-interactive capability, as well as Desktop (Interactive) VTC capability. The PCs will be networked over a fiber optic LAN sharing three centralized CLI CODECS.

The project utilizes dedicated T1 terrestrial lines and a MCU that allows all seven sites to conduct project user and other multisite meetings.

LINDA EATON
Captain, USAF, MSC
Director, Telemedicine
TRICARE Southwest, DoD Region VI
(210) 678-3217
eatonl@triwpgate.af.mil

APPENDIX O

DACH TELEMEDICINE CONCEPTS AND REQUIREMENTS

DARNALL ARMY COMMUNITY HOSPITAL
DEPARTMENT OF EMERGENCY MEDICINE
TELEMEDICINE CONCEPTS AND REQUIREMENTS

MCXI-DEM

24 November 1997

The purpose of this statement is in response to the tasking by the C. IMD and DCCS of Darnall Army Community Hospital for the identification of the concepts and requirements for Telemedicine in the Department of Emergency Medicine at Darnall Army Community Hospital.

The Darnall Army Community Hospital Telemedicine Policy guidelines were authored by Dr. Eric Kobylarz (Dept. of Neurology) and myself at the request of the previous DACH Hospital commander Col. James W. Kirkpatrick.
He authored a command policy document from these guidelines, which was instituted on 24 January 1997.
A summary follows:

Definition: Telemedicine involves the use of telecommunications technologies as a medium for the provision of medical information and services to consumers at sites that are remote from the provider.

Objective   To effectively and expeditiously aid in the evaluation, diagnosis, and treatment of patients at DACH and other health care facilities. The intent is to provide universal access to high-quality care facilities, at an affordable cost through the use of currently available technology.

The DACH telemedicine system will be used for the following purposes:
1. To screen patients evaluated at affiliated satellite clinics to facilitate the triage process.
2. To consult physicians and health care providers at other facilities, military and civilian, for services and subspecialties not available at DACH.
3. To provide remote diagnosis and consultation services for patients at sites remote from DACH.
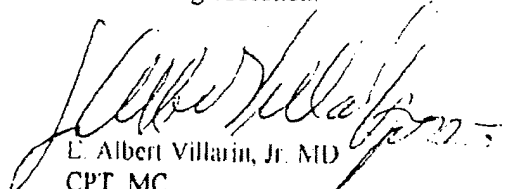
The DACH Telemedicine Standard Operating Procedures include the following:
1. Telemedicine is not to replace existing DACH health services, but will supplement and compliment what is otherwise available.
2. The DACH Telemedicine Service will train personnel to effectively operate the telemedicine apparatus and provide them with assistance should this be needed during the use of the system.
3. Personnel requesting its use by notifying the service to which the unit belongs will reserve the telemedicine apparatus. The service will oversee the schedule.
4. The quality of health care delivered at DACH should never be compromised through the use of Telemedicine. All DACH health care providers should be cognizant of the limitations of this technology and realize when its use is contraindicated for patient evaluation and care.
5. A non-licensed health care provider can operated the telemedicine apparatus under the direction of a licensed health care provider.
6. A licensed health care provider is required to fill out the DA Form 513, which will be faxed to the location of the patient and immediately placed into the patient's medical record.
7. Medication prescriptions for non-Schedule B drugs will be faxed to the location of the patient and filled at the local pharmacy.
8. When invasive procedures are to be performed during the telemedicine consultation, a second telemedicine link will be established at the closest possible location in order to provide a back-up apparatus.
9. The referring service where the patient is located will be provided credit for the workload for the Telemedicine consultation.
10. The DACH telemedicine system must be updated to keep abreast of the current telecommunications and medical technology in order to deliver the best possible health care to the patient.
11. DACH health care providers and patients will be asked to provide constructive feedback regarding their opinion of the telemedicine system and suggestions for its modification in order to continually improve the quality of the system itself and its implementation.

As a previous PROFIS assignment with the C/4FSB of 4ID Advanced Warfighter Exercise at the National Training Center, Fort Irwin, Calif., my responsibility as DACH-Emergency Department (ED) Telemedicine Coordinator was to support the telemedicine initiative during field training exercises. The DACH ED was configured with a Pictel Video-teleconferencing (VTC) cart and was utilized 24hr per day for two weeks. VTC connections for administrative, medical support, and technical evaluations were performed in order to improve telemedicine support. From my experience with this initiative and telemedicine utilization at DACH several requirements have been brought forward.

1 Equipment constraints prevent quality VTC connections between field units and the DACH-ED
   a   Modem speed for digitized and microwave information should be no slower than twin-56kbs. Note that the signal received at the ED is only as good as the signal transmitted from the field station and therefore the field site modems, cameras and satellite equipment should be of high quality. This will provide the closest to "real-time" signals received by ED and, as noted by our experience, a more receptive consultant
   b   Faster T1 or Teleos switching and wiring installed in the hospital communications equipment is recommended for the best visual and sound quality. This is essential for clear visual evaluation of the field patient.
   c. Monitor size should be no smaller than 26 inch if mounted on a cart.
   d   Rotational camera that is already mounted on many VTC units.
   e. Digitization equipment and software are necessary to download x-rays and documentation
   f   The newest laptops now on the market provide the complete basic unit with a screen-mounted camera, digitization software and high-speed data modems and large capacity hard drives. These units are both cost effective and extremely space efficient.

2   The mode in which the Emergency department will perform its duty.
   a. Telemedicine has been in use at many civilian ED's for the past 10 years. They provide connectivity with outlying satellite communities that do not have expert medical care. The DACH-ED is fully staffed by American Board of Emergency Medicine Certified physicians who are practiced in the latest clinical application of emergency care. Field units utilizing telemedicine would greatly benefit from their expertise and support, if the DACH DEM were provided with state of the art equipment. In my opinion, the DEM should be utilized as the consultant service and provide medical support for field units or satellite clinics in the Fort Hood area and those military installations with ED's or clinics not staffed by an emergency physician.
   b. However, in an attempt to maintain rapid patient care support and disposition, I cannot support the mode of connectivity from the ED to in-house or BAMC consult services. The logistical complication of supporting the ED consult requirements on a 24hr basis would make its use impractical. The consulted services would need 24hr access to a VTC in-house. This may be technically solved, but services would have to stay on-call in-house to answer the VTC on an emergency basis as needed to support the DACH-ED with annual visits of 65,000 patients per year.
   c   Since telemedicine is becoming a part of many emergency departments nation wide, training of DACH staff and resident medical personnel in the DEM would also provide a higher level of education and experience for employment in the civilian sector.

3   Quality of patient care issues
   a. As noted on SOP articles 1 and 4 above, by definition, telemedicine does not have a use in the emergency patient whose medical support must come from the department staff and residents on a timely basis. Its utilization, as noted by AWE-NTC patients is predominately for urgent-care patients who do not require consultations for admission to the operating room or ward. Even to this end, specific diagnosis and therapies will eventually rise out of continuous consultation as in dermatologic or radiologic diagnoses.
   b   DEM quality improvement issues require continuous evaluation of patient care and benefits, derived from use of telemedicine, as well as user feedback and continuing education.

L. Albert Villarin, Jr. MD
CPT, MC
Telemedicine Coordinator
DACH-DEM

APPENDIX P

DACH TELEMEDICINE MEMORANDUMS

MCXI-OBG   7 November 1997

MEMORANDUM FOR MEDDAC, DCCS

SUBJECT: Telemedicine

The DACH Department of OB/Gyn has been using telemedicine since the
combined BAMC-WHMC-DACH residency program was started in April 1996.
Currently, we utilize the system on Thursday mornings between 0800 - 1000 for
the purpose of GME/CME conferences. We do not use telemedicine for any
other purposes at this time.

                                    SUSAN G. DUNLOW
                                    MAJOR, Medical Corps
                                    Chief, Dept OB/Gyn

COL Gilman:

The Department of Medicine requests the following telemedicine capabilities:

1) Dial anywhere capability on 4 West--utilized by receiving conferences from Brooke Army Medical Center.

2) Dial anywhere telemedicine capability at the Adult Chronic Care Clinic. This is imperative for the medical resident training program scheduled to begin 6/98, It will be utilized primarily for broadcasting noon conferences and other case presentations/reviews, as well as educational programs.

3) Dial anywhere telemedicine capability in the Dermatology Clinic. This is utilized for resident teaching, as well as case consultation.

It is presumed, that with dial anywhere capability, expanded functions for telemedicine will develop over time.

POC for the Department of Medicine for Telemedicine is MAJ Erik Kobylarz 288-8080. POC for Internal Medicine Clinic and the AC3 is SGT Axel Torres 288-8074. POC for Dermatology is LTC Leo Conger 288-8080.

Memo

To: DCCS through DOS, Linda Jordan

From: H. Close, MD

Date: 11/16/97

Re: Telemedicine

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1. The Otolaryngology service requests support for use of Telemedicine communication on Tuesday mornings from 0800-1000.

2. Otolaryngology combined Telemedicine conferences occur in San Antonio between BAMC, Wilford Hall, and the UT-San Antonio medical school.

3. Residents from the military residency rotate on our service about seven months out of the year. Teaching staffs in San Antonio and Darnall agree that the residents should be able to participate in the Grand rounds that these Telemedicine conferences include. Additionally, our own communication and presentations during these conferences will reinforce that the quality of patient care as well as the diversity of patient pathology at Darnall is an essential part of the Otolaryngology resident's experience. Finally, this forum will facilitate sharing of specific patient's follow up between the medical centers and Darnall.

4. Previous attempts to coordinate this support have been unsuccessful.

5. POC for the above memo is the undersigned at 288-8490.

Heidi L. Close, MD

MAJ, MC
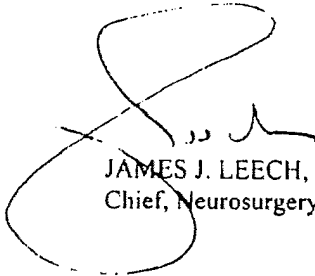
C, Otolaryngology Service

MCX-DOS-NEU

21 Nov 97

MEMORANDUM THROUGH CHIEF, DEPARTMENT OF SURGERY

FOR DEPUTY COMMANDER FOR CLINICAL SERVICES

SUBJECT: Use of telemedicine facilities for consultation

1. It would be highly desirable for me to have access to telemedicine facilities during normal duty hours. This would allow me as a solo practitioner to consult with the orthopedic spine surgery service and pediatric neurosurgery service at Wilford Hall Air Force Medical Center, the neurosurgery service at Brooke Army Medical Center and the neurosurgery service at Walter Reed Army Medical Center. I anticipate that this need will arise only once or twice a month.

2. POC is the undersigned at 286-7118.

JAMES J. LEECH, LTC, MC
Chief, Neurosurgery Service

15 November 1997

MEMORANDUM FOR: COL GILMAN, DCCS
        THRU: LTC RICHARDS, C, DAC

SUBJECT: Response to Tasker # 7309-0002 (Telemedicine)

1. Recommend concept of telemedical operations within the Department of Ambulatory Care be divided into three phases for gradual introduction. Initially, connectivity from the Bennett and Monroe Clinics should be established to provide subspecialty consultation with DACH. Following this, datalink from the FCC-DA to BAMC should be established with parallel lines running from the already integrated TMCs. As a final step, integration of the outlying FCCs in Killeen and Copperas Cove should be set up. There is currently no need to integrate the BAS or other TMCs but we should be prepared for future implementation in the new COSCOM consolidated clinic when it is built. A stepwise approach is sensible in that it allows us to work out bugs within the system, slowly integrate the system into the workplace and provide training to the user while giving the user the opportunity to provide feedback on changes and improvements. Obviously, these steps can be combined into one at the risk of creating a mediocre and untested system (one that providers will not support or use).

2. The key to a successful integration of this type of hardware is three-fold: education, location and reliability. Clearly, an educated provider that realizes the potential benefits to both patient and provider is one who will be motivated to utilize this relatively new technology. Thus, time has to be made available to train providers in the use of this equipment so that it is not seen as an additional task or burden (as CHCS was initially perceived in the late 80's). As an added benefit, our military providers get trained on the use of equipment that may be available the next time they deploy. A room that is large enough to house the telemedicine equipment, the patient and at least one provider will need to be made available at each clinic to allow easy access to the system. This will encourage the use of telemedicine and lessen frustration with time constraints and patient compliance (i.e. patient may not show for follow-up telemedicine consultation). Finally, the system has to be up and running ANY time the clinic is open. Providers will be unlikely to take time out in order to determine functional status prior to using this system; they will revert to using other forms of consultation if there is a perception that this new "gadget" is frequently "down." As an aside, CHCS system should be up and running at all sites with data retrieval/transmission possible all the way to BAMC.

3. The following addresses the question of hardware requirements. As we represent a wide spectrum of providers (FP, GP, PA, FNP, Peds, PNP) we must have a multitude of modules available. Modules for transferring both realtime (or near realtime 10-20 frames per second) and static data (xray, ECG) are required. The WRAMC article (Tab A) and the Telemedicine in Bosnia article (Tab B) further delineate technical specifications of the types of equipment, but the following is a list of likely minimum hardware needs:

    a. Camera attachments for otoscope/opthalmoscope heads (additional light sources needed for optimal resolution?)
    b. Interface between ECG and computer or 600+DPI scanner
    c. Microphone (consider stethoscopic microphone)
    d. Xray view transmission (scanner better than video?)

4. Our HCPs as well as III Corps providers should utilize as this equipment for on the spot consultations with specialists at DACH initially and eventually with BAMC. This should replace the use of telephonic consultation and may require, at least, receiving terminals in all clinics at this hospital in order to be fully effective. Collateral benefit to the use of this technology in garrison by all Ft. Hood HCPs is that it will familiarize and build confidence in a system they will likely encounter and use in a deployed setting. Another sidebar benefit to this technology will be the ability to videoconference CME lectures throughout all of our sites, decreasing driving time and time away from clinical duties.

RONALD KING
MAJ, MC, FS, FAAFP
USA

APPENDIX Q

DACH TELEMEDICINE PROFILE

Re-Engineering Laboratory (REL)

Strategic Technology Planning for the U.S. Army Medical
Department

Technology Profile

TELEMEDICINE

Process Outline
User Survey
Technology Profile

Technology Profile Process
Telemedicine

Identify Initiatives
AMEDD C&S

User Survey
Initiative POC

Brief and Site Visit
REL Team

Review and Follow-up
REL Team
Initiative POC

Market Evaluation → **Initiative Analysis**

REL Team

REL Team
AMEDD C&S
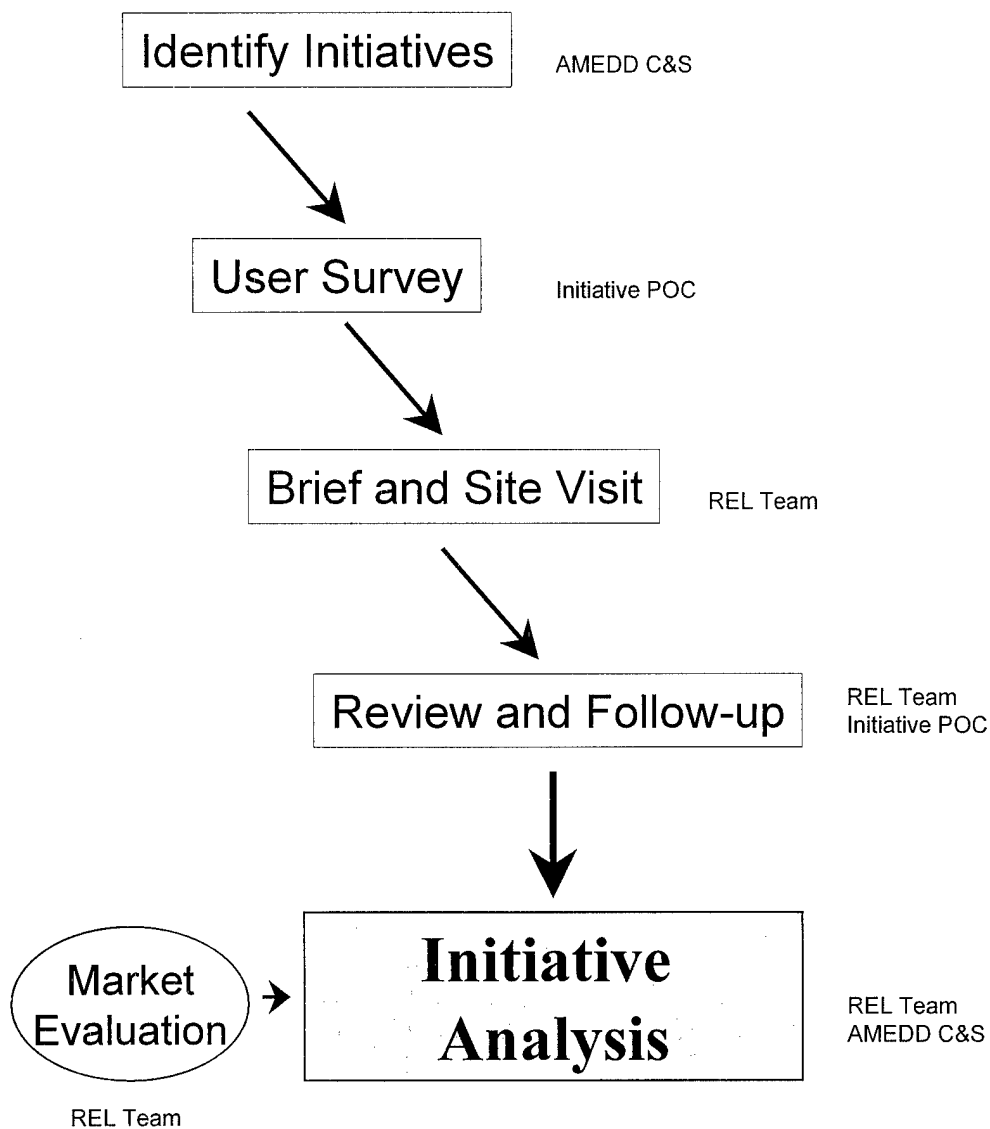
Telemedicine Initiative
User Survey
To be completed by initiative site and returned before briefing and site visit

DARNALL ARMY COMMUNITY HOSPITAL (DACH)

Title of initiative: BAMC/DACH Hospital without walls

Point of contact:
Name: Everett E. Pitt Jr.
Title: Chief, Telecommunications
Address: Darnall Army Community Hospital, Ft. Hood
Telephone: (254) 288-8863
FAX: (254) 287-1943
Email: ed_pitt@smtplink.hood.amedd.army.mil
URL: N/A

Initiative proponent or sponsor: MEDCOM

Description of initiative:
describe the overall objective, current practice or approach, limitations of current practice that will be addressed by the new technology, and method for using the new technology

Provide link between BAMC/DACH for consults physician/patients at remote locations and realize care by keeping soldiers at home station rather than sending to BAMC.

Application scenario:
provide one or more examples of use, focusing on the clinical environment, when appropriate
- Neonatal Intensive Care
- Dermatology
- Internal Medicine

List sites at which the technology will be used:

At this time, Darnall has capability to utilize 20 locations for telemedicine/video conferencing purposes. With the install of the DS3 MEDNET network and the TELEOS switch, dial up to anywhere with telemedicine equipment could be achievable. Presently this network is not being utilized to the full extent duet o ongoing equipment problems. However, thru the use of point-to-point technology (T1), we do utilize telemdicine in our NICU and dermatology units.

Once the problems we are experiencing with our NEC equipment has been resolved, we will have dial anywhere capability from any of the following areas:

        NeoNatal Intensive Care Units
        Dermatology
        Emergency Room
        Internal Medicine Clinic
        Pediatric Clinic
        OB/GYN Clinic
        Opthalmology Clinic
        AC-3 Trimmier Clinic (remote clinic located in downtown Kileen)

Use of our PICTEL equipment allows the use of 5 locations which can use the MEDNET network but this is only used at this time for resident training and videoconferencing between different locations in the US

        Commanders Office
        Hospital Auditorium
        Command Conference Room
        Logistics Conference Room
        DCCS Conference Room
        CSD Conference Room
        Region VI Lead Agent (5th Floor location)

Following locations are presently wired but not equipped at the TELEOS. These locations are being planned for the future

        Pathology
        Psychiatry
        Radiology
        Surgery

Timeline of initiative:
date work started, date of first clinical use, date of full implementation, anticipated length of project
        April 96 (ongoing)

Accomplishments to date:

Major accomplishments derived from cost savings, actual savings of a newborn utilizing echo via telecommunications utilizing MEDNET network

System components:

list hardware, software, networking, telecommunications requirements

- 10 each NEC Telemedicine Carts (Roll-around)
- 2 each PicTel Units
- 1 each VTEL Unit

Telemedicine Initiative

Technology Profile

To be completed by the REL Team

MISSION

Unable to provide actual data*/Estimates only

1. Category of Technology

% time used for each

Direct clinical care: *only* **Derm and NICO currently**

- ❑ diagnostic   _100%___
- ❑ therapeutic   _____
- ❑ preventive   _____

Non-clinical use:

- ❑ administrative   _10%__
- ❑ education/training   _30%__
- ❑ health promotion   _30%__
- ❑ logistical   _15%__
- ❑ marketing/improve morale _15%__

2. Application Environment

Combat casualty care

- ❑ reduce battlespace deaths(KIA)   _0%__
- ❑ reduce evacuations   _0%__
- ❑ reduce combat stress   _0%__

Keep AD forces on job

- ❑ disease management (DNBI) (deployed)   _0%__
- ❑ disease management (DNBI) (sustaining base)   _50%__
  (Dermatology Only)

- ❑ Preventive (deployed)   _0%__
- ❑ Preventive (sustaining base)   _25%__
- ❑ Humanitarian assistance (non-DOD beneficiary)   _0%__
- ❑ Sustaining base (beneficiary care)   _0%__
- ❑ Reduce MHSS skill mix and staffing   _25%__
- ❑ Reduce health service requirements of
  TRICARE support contractors   _0%__
- ❑ Keep beneficiaries at work or home   _0%__

* Actual usage data not collected due to 1) system not operational or 2) usage not documented – Estimates provided by DACH personnel

3. End User

- ❑ Individual
  - ❑ Combat arms   0%
  - ❑ Combat service support   0%
- ❑ Unit (Echelon 1-2)   0%
- ❑ Unit (Echelon 3-4)   0%
- ❑ Sustaining base (Echelon 5, CONUS)   100%

4. Role of AMEDD in this initiative

❑ Researcher
determines fundamental knowledge related to the scientific or engineering field being investigated

❑ Developer
solves technical and engineering problems related to the production of the finished product

❑ Systems Integrator
combines products from multiple sources intoa unique product, may add proprietary hardware or software to system

❑ Evaluator
conducts or participates in clinical or technical trials, including usability testing

❑ Advisor
provides clinical, military, or technical expertise to developers

❑ None

5. Initiative Driver

- ❑ Investigator-initiated (investigator academic or clinical interests)
- ❑ Centrally directed (USAMRMC, DOD-HA, AMEDD C&S, etc.)

6. How is access to the initiative determined?
What patients and providers participate? How are they selected?

7. Customer base

number of users	??
number of units/devices	10 NEC, 2 PicTel, 2 VTEL
number of uses per time unit	??
number of units in use now	2 PicTel, 2 VTEL
total number of units needed	0

8. Market penetration
Uses of the technology/total incidence or number of uses

one year ago	??
today	??
one year from now (estimated)	2-3x day

MATURITY

9. Technology Sources
list all that apply

Non-developmental item
- ❏ commercial off-the-shelf (COTS)
- ❏ government of-the-shelf (GOTS)

Developmental
- ❏ enhanced (customized) GOTS/COTS PicTEL, VTEL
- ❏ custom ("one-off," finished product) NEC Units
- ❏ prototype (as a phase of development)

10. Integration with existing IM/IS infrastructure
- ❏ Yes

  ❏ full functionality Part of TELEOS System
  ❏ demonstration mode only
- ❏ No

11. Anticipated time to mainstream acceptance and use
- ❏ Today (1997-2000)
- ❏ Transition (2000-2007)
- ❏ Force XXI (2007-2017)
- ❏ Army After Next (2017-2025)
- ❏ Army of the future (beyond 2025)

12. Barriers to entry
- ❏ development cost
- ❏ unit cost
- ❏ complexity
- ❏ physician/provider resistance
- ❏ patient resistance
- ❏ immature technology
- ❏ competing product or practice

13. FDA regulatory status
- ❏ None
- ❏ Under review
  - ❏ 501k
  - ❏ PMA
- ❏ Approved

PERFORMANCE

14. Describe the system components
model, peripherals, software version, weight/cube, power requirements, MILSPEC, etc.

Hardware

Software: Custom from Andreas Tech - NEC

Networking

Telecommunications

15. What data fields are: Point to Point
acquired:
transmitted:
archived:

16. **How is data transmitted?** Through MedNet

17. **What are the bandwidth requirements?** Variable 56KBs to T1

18. **What data standards are currently used?**
(e.g., HL7, DICOM, TCP/IP, H32x)

19. **What is the system load?** Unknown
(frequency of use, time per use)

20. **How is integration with existing IM/IS resources achieved?**
Using Internet through SYSCO Router

21. **Is the system used in a clinical evaluation process?** NO

22. **Is the process approved by a duly constituted institutional review board?** NO

RELIABILITY

23. What is the reliability level?
number of times use is successful/number of times use attempted

Point to Point (reliable), dial-anywhere (not reliable)
95% NEC with T1, major problems with Dial-anywhere capability

24. What are the service requirements?
routine:
unscheduled: Mostly call Andreas Tech for trouble shooting service as needed

25. What personnel are allocated to
system administration:
technical service support: 2 FTEs

26. In what environments is the system designed to operate?
NEC – Clinical Environments

27. In what field environments has the system been tested?
At Vendors, in hospital, in units, DACH and BAMC

28. What training is required before using the system?

Clinicians are taught to turn on the units and basic troubleshooting. IMO
personnel are available for troubleshooting if needed.

APPENDIX R

BJACH TELEMEDICINE PROFILE

Telemedicine Initiative

User Survey

To be completed by initiative site and returned before briefing and site visit

FORM WAS NOT COMPLETED PRIOR TO SITE VISIT

Title of initiative: Bayne-Jones Army Community Hospital

Point of contact:
Name: 1LT Tom Baker
Title: Chief Information Officer (CIO)
Address: Ft. Polk, Louisiana
Telephone: (318) 531-3819
FAX: (318) 531-3212
Email: 1LT_Thomas_Baker@polk.smtplink.amedd.army.mil
URL:

Initiative proponent or sponsor: Information Not Available

Description of initiative:
describe the overall objective, current practice or approach, limitations of current practice that will be addressed by the new technology, and method for using the new technology
        Information Not Available

Application scenario:
provide one or more examples of use, focusing on the clinical environment, when appropriate
        Information Not Available

List sites at which the technology will be used:
        Information Not Available

Timeline of initiative:
date work started, date of first clinical use, date of full implementation, anticipated length of project
        Information Not Available

Accomplishments to date:
        Information Not Available

System components:
list hardware, software, networking, telecommunications requirements)

        Information Not Available

Telemedicine Initiative

Technology Profile

To be completed by the REL Team

MISSION

1. Category of Technology

% time used for each

Direct clinical care:

- ❑ diagnostic   __0%___
- ❑ therapeutic   __0%___
- ❑ preventive   0%

Non-clinical use:

- ❑ administrative   ___?___
- ❑ education/training   ___?___
- ❑ health promotion   _____
- ❑ logistical   _____
- ❑ marketing/improve morale _____

2. Application Environment

Combat casualty care
- ❑ reduce battlespace deaths(KIA) _____
- ❑ reduce evacuations   _____
- ❑ reduce combat stress _____

Keep AD forces on job
- ❑ disease management (DNBI) (deployed) _____
- ❑ disease management (DNBI) (sustaining base) _____

- ❑ **Preventive** (deployed) _____
- ❑ **Preventive** (sustaining base) _____
- ❑ **Humanitarian assistance** (non-DOD beneficiary) _____
- ❑ **Sustaining base (beneficiary care)** _____
- ❑ **Reduce MHSS skill mix and staffing** _____
- ❑ **Reduce health service requirements of TRICARE support contractors** _____
- ❑ **Keep beneficiaries at work or home** _____

3. End User

- ❏ Individual
    - ❏ Combat arms   _____
    - ❏ Combat service support   _____
- ❏ Unit (Echelon 1-2)   _____
- ❏ Unit (Echelon 3-4)   _____
- ❏ Sustaining base (Echelon 5, CONUS)   _____

4. Role of AMEDD in this initiative

- ❏ Researcher

  determines fundamental knowledge related to the scientific or engineering field being investigated

- ❏ Developer

  solves technical and engineering problems related to the production of the finished product

- ❏ Systems Integrator

  combines products from multiple sources into a unique product, may add proprietary hardware or software to system

- ❏ Evaluator

  conducts or participates in clinical or technical trials, including usability testing

- ❏ Advisor

  provides clinical, military, or technical expertise to developers

- ❏ None

5. Initiative Driver

- ❏ Investigator-initiated (investigator academic or clinical interests)
- ❏ Centrally directed (USAMRMC, DOD-HA, AMEDD C&S, etc.)

6. How is access to the initiative determined?

What patients and providers participate? How are they selected?

7. Customer base

number of users   _____
number of units/devices   _____
number of uses per time unit   _____
number of units in use now   _____
total number of units needed   _____

8. Market penetration

Uses of the technology/total incidence or number of uses

one year ago   _____
today   _____
one year from now (estimated)   _____

MATURITY

9. Technology Sources
list all that apply

Non-developmental item

- ❑ commercial off-the-shelf (COTS)
- ❑ government of-the-shelf (GOTS)

Developmental

- ❑ enhanced (customized) GOTS/COTS
- ❑ custom ("one-off," finished product)
- ❑ prototype (as a phase of development)

10. Integration with existing IM/IS infrastructure

- ❑ Yes
  - ❑ full functionality
  - ❑ demonstration mode only
- ❑ No

11. Anticipated time to mainstream acceptance and use

- ❑ Today (1997-2000)
- ❑ Transition (2000-2007)
- ❑ Force XXI (2007-2017)
- ❑ Army After Next (2017-2025)
- ❑ Army of the future (beyond 2025)

12. Barriers to entry

- ❑ development cost
- ❑ unit cost
- ❑ complexity
- ❑ physician/provider resistance
- ❑ patient resistance
- ❑ immature technology
- ❑ competing product or practice

13. FDA regulatory status

- ❑ None
- ❑ Under review
  - ❑ 501k
  - ❑ PMA
- ❑ Approved

PERFORMANCE

14. Describe the system components
model, peripherals, software version, weight/cube, power requirements, MILSPEC, etc.

Hardware   INFORMATION NOT AVAILABLE

Software

Networking

Telecommunications

15. What data fields are   INFORMATION NOT AVAILABLE
acquired:
transmitted:
archived:

16. How is data transmitted?   INFORMATION NOT AVAILABLE

17. What are the bandwidth requirements?   INFORMATION NOT AVAILABLE

18. What data standards are currently used?
(e.g., HL7, DICOM, TCP/IP, H32x)
INFORMATION NOT AVAILABLE

19. What is the system load ?
(frequency of use, time per use)
INFORMATION NOT AVAILABLE

20. How is integration with existing IM/IS resources achieved?
INFORMATION NOT AVAILABLE

21. Is the system used in a clinical evaluation process?
INFORMATION NOT AVAILABLE

22. Is the process approved by a duly constituted institutional review board?
NO

RELIABILITY

23. What is the reliability level?   INFORMATION NOT AVAILABLE

number of times use is successful/number of times use attempted

24. What are the service requirements?
       routine: INFORMATION NOT AVAILABLE
       unscheduled:

25. What personnel are allocated to
       system administration:
       technical service support:
                    INFORMATION NOT AVAILABLE

26. In what environments is the system designed to operate?

                    INFORMATION NOT AVAILABLE

27. In what field environments has the system been tested?

                    INFORMATION NOT AVAILABLE

28. What training is required before using the system?

                    INFORMATION NOT AVAILABLE

APPENDIX S

MEDNET CONFIGURATION MAP

MEDNET

As of 30 Jan 98
1700 hrs.

CHPPM N35

DETRICK N31

PENTAGON

N41 BRAGG

N42 BRAGG

N40 BRAGG

N61 JACKSON

N62 STEWART

N63 CAMPBELL

N64 MCPHERSON

N65 BENNING

N66 RUCKER

N67 REDSTONE

BUCHANAN N69

KEY WEST N211

N30 WRAMC

N33 OTSG

N14 SILL

N12 POLK

CTA N68

N60 EAMC

N206 JACKSONVILLE

MAYPORT N212

KINGS BAY N213

PENSACOLA N210

N3 Ft BELVOIR

N11 HOOD

N8 NOD

N151 HOLLIMAN

PATRICK AFB N161

SHAW AFB N166

ROBINS AFB N165

N83 LEAVENWORTH

N19 MEDCOM

N51 BLISS

N209 CHARLESTON

N160 McDILL AFB

MOODY AFB N164

N82 RILEY

N52 HUACHUCA

N153 NELLIS

N81 L WOOD

N10 BAMC

N152 CANNON

NISE T

BEAUFORT N208

PARIS ISLAND N207

EGLIN AFB N163

N80 CARSON

N101 TRICARE

N111 ALTUS

N112 RANDOLPH

N113 KELLY

N114 BROOKS

N18 TIMPO

N100 WHMC

N201 CORPUS

N21 WAINWRIGHT

GREELEY

N20 MAMC

N103 DYESS

N104 GOODFELLOW

N105 LAUGHLIN

N106 TINKER

N107 VANCE

N108 BARKSDALE

N109 LITTLEROCK

N110 SHEPPARD

N70 TAMC

Equip On order

Equip On hand

To be surveyed
To be surveyed

Surveyed/awaiting install
Survey/awaiting install

Site Installed
Site Installed

ON ORDER

T1 - working

DS3 - working

APPENDIX T

BAMC BILLING REPORT FOR 25 FEB 98

CALL DURATION REPORT FOR DEVICE N10 (BAMC)
Mon 2/16/98 0000 to Monday 2/23/98 23:59:00

ᵗcord #

DATE

Connect Time

Multi Day?

COUNT	SUM	DURATION (# MIN)	TOTAL MINUTES	
	43	WH N100 MDIS	SUM WH N100 MDIS	182.99
	5	WH N100 Other	SUM WH N100 OTHER	93764.65
	9	Intra BAMC	Sum Intra BAMC Min	591341.55
	25	NOD N8	SUM NOD N8	2081.96
	3	DACH N11	SUM DACH N11	41788.52
	1	POLK N12	SUM POLK N12	66666.2
	2	SILL N14	SUM SILL N14	12236.88
	1	MEDCOM N19	SUM MEDCOM N19	84789.8
	3	MAMC N20	SUM MAMC N20	91940.36
	1	BLISS N51	SUM BLISS N51	25172.22
	2	EAMC N60	SUM EAMC N60	55732.86
	1	TAMC N70	SUM TAMC N70	91791.15
	4	CARSON N80	SUM CARSON N80	57318.7
	2	REILEY N82	SUM REILEY N82	58.94
	1	LEVENWORTH N83	SUM LEVENWORTH N83	30715.07

TOTAL TIME (min) 1049112.96

Origination Port	Termination Port	Connect Time mm/dd/yy hh:mm:ss	Disconnect Time mm/dd/yy hh:mm:ss	Duration ddd:hh:mm:ss
N10C58P25	N100C58P45	02/16/98 08:02:03	02/16/98 08:06:48	000:00:04:45
N10C58P26	N100C58P44	02/16/98 08:02:03	02/16/98 08:06:48	000:00:04:45
N10C58P27	N100C58P43	02/16/98 08:02:03	02/16/98 08:06:48	000:00:04:45
N10C58P28	N100C58P42	02/16/98 08:02:03	02/16/98 08:06:48	000:00:04:45
N10C58P29	N100C58P41	02/16/98 08:02:04	02/16/98 08:06:48	000:00:04:44
N10C58P30	N100C58P40	02/16/98 08:02:04	02/16/98 08:06:48	000:00:04:44
N10C58P31	N100C58P39	02/16/98 08:02:06	02/16/98 08:06:50	000:00:04:44
N10C58P32	N100C58P38	02/16/98 08:02:06	02/16/98 08:06:50	000:00:04:44
N10C58P33	N100C58P37	02/16/98 08:02:06	02/16/98 08:06:50	000:00:04:44
N10C58P37	N100C58P33	02/16/98 08:02:08	02/16/98 08:06:51	000:00:04:43
N10C58P38	N100C58P32	02/16/98 08:02:08	02/16/98 08:06:51	000:00:04:43
N10C58P34	N100C58P36	02/16/98 08:02:06	02/16/98 08:06:51	000:00:04:45
N10C58P39	N100C58P31	02/16/98 08:02:09	02/16/98 08:06:51	000:00:04:42
N10C58P35	N100C58P35	02/16/98 08:02:07	02/16/98 08:06:51	000:00:04:44
N10C58P40	N100C58P30	02/16/98 08:02:10	02/16/98 08:06:52	000:00:04:42
N10C58P36	N100C58P34	02/16/98 08:02:08	02/16/98 08:06:52	000:00:04:44
N10C58P41	N100C58P29	02/16/98 08:02:10	02/16/98 08:06:52	000:00:04:42
C58P42	N100C58P28	02/16/98 08:02:10	02/16/98 08:06:52	000:00:04:42
JC58P43	N100C58P27	02/16/98 08:02:11	02/16/98 08:06:53	000:00:04:42
N10C58P44	N100C58P26	02/16/98 08:02:11	02/16/98 08:06:53	000:00:04:42
N10C58P45	N100C58P25	02/16/98 08:02:11	02/16/98 08:06:53	000:00:04:42
N10C58P46	N100C58P24	02/16/98 08:02:12	02/16/98 08:06:54	000:00:04:42
N10C58P24	N100C58P46	02/16/98 08:01:49	02/16/98 08:06:54	000:00:05:05
N10C25P46	N8C26P0	02/17/98 06:08:13	02/17/98 06:09:10	000:00:00:57
N10C25P45	N8C26P1	02/17/98 06:08:30	02/17/98 06:09:11	000:00:00:41
N10C58P25	N100C58P45	02/17/98 09:58:47	02/17/98 10:04:32	000:00:05:45
N10C58P26	N100C58P44	02/17/98 09:58:47	02/17/98 10:04:32	000:00:05:45
N10C58P27	N100C58P43	02/17/98 09:58:47	02/17/98 10:04:32	000:00:05:45
N10C58P28	N100C58P42	02/17/98 09:58:47	02/17/98 10:04:32	000:00:05:45
N10C58P29	N100C58P41	02/17/98 09:58:47	02/17/98 10:04:32	000:00:05:45
N10C58P30	N100C58P40	02/17/98 09:58:48	02/17/98 10:04:32	000:00:05:44
N10C58P31	N100C58P39	02/17/98 09:58:50	02/17/98 10:04:32	000:00:05:42
N10C58P32	N100C58P38	02/17/98 09:58:49	02/17/98 10:04:32	000:00:05:43
N10C58P33	N100C58P37	02/17/98 09:58:51	02/17/98 10:04:33	000:00:05:42
N10C58P34	N100C58P36	02/17/98 09:58:50	02/17/98 10:04:33	000:00:05:43
N10C58P35	N100C58P35	02/17/98 09:58:50	02/17/98 10:04:33	000:00:05:43
N10C58P36	N100C58P34	02/17/98 09:58:51	02/17/98 10:04:33	000:00:05:42
N10C58P37	N100C58P33	02/17/98 09:58:53	02/17/98 10:04:34	000:00:05:41
N10C58P38	N100C58P32	02/17/98 09:58:53	02/17/98 10:04:34	000:00:05:41
N10C58P39	N100C58P31	02/17/98 09:58:53	02/17/98 10:04:34	000:00:05:41
N10C58P40	N100C58P30	02/17/98 09:58:53	02/17/98 10:04:34	000:00:05:41
N10C58P41	N100C58P29	02/17/98 09:58:54	02/17/98 10:04:34	000:00:05:40
C58P42	N100C58P28	02/17/98 09:58:53	02/17/98 10:04:34	000:00:05:41
C58P43	N100C58P27	02/17/98 09:58:55	02/17/98 10:04:34	000:00:05:39
N10C58P44	N100C58P26	02/17/98 09:58:56	02/17/98 10:04:35	000:00:05:39
N10C58P45	N100C58P25	02/17/98 09:58:56	02/17/98 10:04:35	000:00:05:39
N10C58P46	N100C58P24	02/17/98 09:58:56	02/17/98 10:04:35	000:00:05:39
N10C58P24	N100C58P46	02/17/98 09:58:33	02/17/98 10:04:35	000:00:06:02
N10C58P25	N100C58P45	02/17/98 12:12:15	02/17/98 12:14:26	000:00:02:11

Call Duration Report for device N10
Mon Feb 23 11:59:41 1998

From 02/16/98 00:00:00 to 02/23/98 23:59:00

Origination Port	Termination Port	Connect Time mm/dd/yy hh:mm:ss	Disconnect Time mm/dd/yy hh:mm:ss	Duration ddd:hh:mm:ss
N10C58P26	N100C58P44	02/17/98 12:12:15	02/17/98 12:14:27	000:00:02:12
N10C58P27	N100C58P43	02/17/98 12:12:16	02/17/98 12:14:27	000:00:02:11
N10C58P28	N100C58P42	02/17/98 12:12:16	02/17/98 12:14:27	000:00:02:11
N10C58P29	N100C58P41	02/17/98 12:12:16	02/17/98 12:14:27	000:00:02:11
N10C58P30	N100C58P40	02/17/98 12:12:16	02/17/98 12:14:27	000:00:02:11
N10C58P31	N100C58P39	02/17/98 12:12:17	02/17/98 12:14:27	000:00:02:10
N10C58P32	N100C58P38	02/17/98 12:12:18	02/17/98 12:14:28	000:00:02:10
N10C58P33	N100C58P37	02/17/98 12:12:18	02/17/98 12:14:28	000:00:02:10
N10C58P24	N100C58P46	02/17/98 12:12:01	02/17/98 12:14:28	000:00:02:27
N10C58P34	N100C58P36	02/17/98 12:12:19	02/17/98 12:14:28	000:00:02:09
N10C58P35	N100C58P35	02/17/98 12:12:19	02/17/98 12:14:28	000:00:02:09
N10C58P36	N100C58P34	02/17/98 12:12:19	02/17/98 12:14:28	000:00:02:09
N10C58P37	N100C58P33	02/17/98 12:12:20	02/17/98 12:14:28	000:00:02:08
N10C58P38	N100C58P32	02/17/98 12:12:21	02/17/98 12:14:28	000:00:02:07
N10C58P39	N100C58P31	02/17/98 12:12:21	02/17/98 12:14:28	000:00:02:07
N10C58P40	N100C58P30	02/17/98 12:12:21	02/17/98 12:14:28	000:00:02:07
N10C58P41	N100C58P29	02/17/98 12:12:22	02/17/98 12:14:28	000:00:02:06
?C58P42	N100C58P28	02/17/98 12:12:22	02/17/98 12:14:28	000:00:02:06
.0C58P43	N100C58P27	02/17/98 12:12:23	02/17/98 12:14:28	000:00:02:05
N10C58P44	N100C58P26	02/17/98 12:12:23	02/17/98 12:14:28	000:00:02:05
N10C58P45	N100C58P25	02/17/98 12:12:24	02/17/98 12:14:28	000:00:02:04
N10C58P46	N100C58P24	02/17/98 12:12:24	02/17/98 12:14:28	000:00:02:04
N10C58P25	N100C58P45	02/17/98 13:38:13	02/17/98 13:39:37	000:00:01:24
N10C58P26	N100C58P44	02/17/98 13:38:14	02/17/98 13:39:38	000:00:01:24
N10C58P27	N100C58P43	02/17/98 13:38:14	02/17/98 13:39:38	000:00:01:24
N10C58P28	N100C58P42	02/17/98 13:38:14	02/17/98 13:39:38	000:00:01:24
N10C58P29	N100C58P41	02/17/98 13:38:14	02/17/98 13:39:38	000:00:01:24
N10C58P30	N100C58P40	02/17/98 13:38:14	02/17/98 13:39:38	000:00:01:24
N10C58P31	N100C58P39	02/17/98 13:38:16	02/17/98 13:39:38	000:00:01:22
N10C58P33	N100C58P37	02/17/98 13:38:17	02/17/98 13:39:40	000:00:01:23
N10C58P34	N100C58P36	02/17/98 13:38:17	02/17/98 13:39:40	000:00:01:23
N10C58P35	N100C58P35	02/17/98 13:38:18	02/17/98 13:39:40	000:00:01:22
N10C58P36	N100C58P34	02/17/98 13:38:18	02/17/98 13:39:40	000:00:01:22
N10C58P37	N100C58P33	02/17/98 13:38:18	02/17/98 13:39:40	000:00:01:22
N10C58P38	N100C58P32	02/17/98 13:38:19	02/17/98 13:39:41	000:00:01:22
N10C58P39	N100C58P31	02/17/98 13:38:19	02/17/98 13:39:41	000:00:01:22
N10C58P40	N100C58P30	02/17/98 13:38:19	02/17/98 13:39:41	000:00:01:22
N10C58P32	N100C58P38	02/17/98 13:38:16	02/17/98 13:39:42	000:00:01:26
N10C58P41	N100C58P29	02/17/98 13:38:20	02/17/98 13:39:42	000:00:01:22
N10C58P42	N100C58P28	02/17/98 13:38:21	02/17/98 13:39:43	000:00:01:22
N10C58P43	N100C58P27	02/17/98 13:38:21	02/17/98 13:39:43	000:00:01:22
N10C58P44	N100C58P26	02/17/98 13:38:22	02/17/98 13:39:43	000:00:01:21
'0C58P45	N100C58P25	02/17/98 13:38:22	02/17/98 13:39:43	000:00:01:21
JC58P46	N100C58P24	02/17/98 13:38:23	02/17/98 13:39:44	000:00:01:21
N10C58P24	N100C58P46	02/17/98 13:38:00	02/17/98 13:39:44	000:00:01:44
N10C58P25	N100C58P45	02/17/98 13:40:31	02/17/98 13:41:57	000:00:01:26
N10C58P26	N100C58P44	02/17/98 13:40:31	02/17/98 13:41:57	000:00:01:26
N10C58P27	N100C58P43	02/17/98 13:40:31	02/17/98 13:41:57	000:00:01:26
N10C58P28	N100C58P42	02/17/98 13:40:32	02/17/98 13:41:58	000:00:01:26

Call Duration Report for device N10
Mon Feb 23 11:59:41 1998

From 02/16/98 00:00:00 to 02/23/98 23:59:00

Origination Port	Termination Port	Connect Time mm/dd/yy hh:mm:ss	Disconnect Time mm/dd/yy hh:mm:ss	Duration ddd:hh:mm:ss
N10C58P29	N100C58P41	02/17/98 13:40:32	02/17/98 13:41:58	000:00:01:26
N10C58P30	N100C58P40	02/17/98 13:40:32	02/17/98 13:41:58	000:00:01:26
N10C58P31	N100C58P39	02/17/98 13:40:34	02/17/98 13:41:58	000:00:01:24
N10C58P24	N100C58P46	02/17/98 13:40:17	02/17/98 13:41:59	000:00:01:42
N10C58P32	N100C58P38	02/17/98 13:40:33	02/17/98 13:41:59	000:00:01:26
N10C58P33	N100C58P37	02/17/98 13:40:35	02/17/98 13:42:00	000:00:01:25
N10C58P34	N100C58P36	02/17/98 13:40:35	02/17/98 13:42:00	000:00:01:25
N10C58P35	N100C58P35	02/17/98 13:40:35	02/17/98 13:42:00	000:00:01:25
N10C58P36	N100C58P34	02/17/98 13:40:35	02/17/98 13:42:00	000:00:01:25
N10C58P37	N100C58P33	02/17/98 13:40:37	02/17/98 13:42:00	000:00:01:23
N10C58P38	N100C58P32	02/17/98 13:40:37	02/17/98 13:42:00	000:00:01:23
N10C58P39	N100C58P31	02/17/98 13:40:37	02/17/98 13:42:00	000:00:01:23
N10C58P40	N100C58P30	02/17/98 13:40:38	02/17/98 13:42:00	000:00:01:22
N10C58P41	N100C58P29	02/17/98 13:40:38	02/17/98 13:42:00	000:00:01:22
N10C58P42	N100C58P28	02/17/98 13:40:38	02/17/98 13:42:00	000:00:01:22
N10C58P43	N100C58P27	02/17/98 13:40:39	02/17/98 13:42:00	000:00:01:21
N10C58P44	N100C58P26	02/17/98 13:40:40	02/17/98 13:42:00	000:00:01:20
`C58P45	N100C58P25	02/17/98 13:40:40	02/17/98 13:42:00	000:00:01:20
JC58P46	N100C58P24	02/17/98 13:40:40	02/17/98 13:42:00	000:00:01:20
N10C58P25	N100C58P45	02/17/98 14:26:02	02/17/98 14:26:50	000:00:00:48
N10C58P26	N100C58P44	02/17/98 14:26:03	02/17/98 14:26:51	000:00:00:48
N10C58P27	N100C58P43	02/17/98 14:26:04	02/17/98 14:26:51	000:00:00:47
N10C58P28	N100C58P42	02/17/98 14:26:04	02/17/98 14:26:51	000:00:00:47
N10C58P29	N100C58P41	02/17/98 14:26:04	02/17/98 14:26:51	000:00:00:47
N10C58P30	N100C58P40	02/17/98 14:26:04	02/17/98 14:26:51	000:00:00:47
N10C58P31	N100C58P39	02/17/98 14:26:06	02/17/98 14:26:52	000:00:00:46
N10C58P32	N100C58P38	02/17/98 14:26:06	02/17/98 14:26:52	000:00:00:46
N10C58P33	N100C58P37	02/17/98 14:26:06	02/17/98 14:26:53	000:00:00:47
N10C58P34	N100C58P36	02/17/98 14:26:06	02/17/98 14:26:53	000:00:00:47
N10C58P35	N100C58P35	02/17/98 14:26:07	02/17/98 14:26:53	000:00:00:46
N10C58P36	N100C58P34	02/17/98 14:26:07	02/17/98 14:26:53	000:00:00:46
N10C58P37	N100C58P33	02/17/98 14:26:08	02/17/98 14:26:53	000:00:00:45
N10C58P38	N100C58P32	02/17/98 14:26:08	02/17/98 14:26:53	000:00:00:45
N10C58P39	N100C58P31	02/17/98 14:26:10	02/17/98 14:26:54	000:00:00:44
N10C58P40	N100C58P30	02/17/98 14:26:09	02/17/98 14:26:54	000:00:00:45
N10C58P41	N100C58P29	02/17/98 14:26:09	02/17/98 14:26:54	000:00:00:45
N10C58P42	N100C58P28	02/17/98 14:26:10	02/17/98 14:26:54	000:00:00:44
N10C58P43	N100C58P27	02/17/98 14:26:11	02/17/98 14:26:54	000:00:00:43
N10C58P44	N100C58P26	02/17/98 14:26:12	02/17/98 14:26:55	000:00:00:43
N10C58P45	N100C58P25	02/17/98 14:26:12	02/17/98 14:26:56	000:00:00:44
N10C58P24	N100C58P46	02/17/98 14:25:49	02/17/98 14:26:56	000:00:01:07
N10C58P25	N100C58P45	02/17/98 14:28:49	02/17/98 14:31:23	000:00:02:34
`0C58P26	N100C58P44	02/17/98 14:28:49	02/17/98 14:31:23	000:00:02:34
C58P27	N100C58P43	02/17/98 14:28:49	02/17/98 14:31:23	000:00:02:34
N10C58P28	N100C58P42	02/17/98 14:28:49	02/17/98 14:31:23	000:00:02:34
N10C58P29	N100C58P41	02/17/98 14:28:49	02/17/98 14:31:23	000:00:02:34
N10C58P30	N100C58P40	02/17/98 14:28:49	02/17/98 14:31:23	000:00:02:34
N10C58P31	N100C58P39	02/17/98 14:28:52	02/17/98 14:31:24	000:00:02:32
N10C58P32	N100C58P38	02/17/98 14:28:52	02/17/98 14:31:24	000:00:02:32

Call Duration Report for device N10
Mon Feb 23 11:59:41 1998

From 02/16/98 00:00:00 to 02/23/98 23:59:00

Origination Port	Termination Port	Connect Time mm/dd/yy hh:mm:ss	Disconnect Time mm/dd/yy hh:mm:ss	Duration ddd:hh:mm:ss
N10C58P33	N100C58P37	02/17/98 14:28:52	02/17/98 14:31:24	000:00:02:32
N10C58P24	N100C58P46	02/17/98 14:28:35	02/17/98 14:31:25	000:00:02:50
N10C58P34	N100C58P36	02/17/98 14:28:53	02/17/98 14:31:25	000:00:02:32
N10C58P35	N100C58P35	02/17/98 14:28:53	02/17/98 14:31:25	000:00:02:32
N10C58P36	N100C58P34	02/17/98 14:28:53	02/17/98 14:31:25	000:00:02:32
N10C58P37	N100C58P33	02/17/98 14:28:55	02/17/98 14:31:25	000:00:02:30
N10C58P38	N100C58P32	02/17/98 14:28:55	02/17/98 14:31:25	000:00:02:30
N10C58P39	N100C58P31	02/17/98 14:28:55	02/17/98 14:31:25	000:00:02:30
N10C58P40	N100C58P30	02/17/98 14:28:56	02/17/98 14:31:25	000:00:02:29
N10C58P41	N100C58P29	02/17/98 14:28:56	02/17/98 14:31:25	000:00:02:29
N10C58P42	N100C58P28	02/17/98 14:28:56	02/17/98 14:31:25	000:00:02:29
N10C58P43	N100C58P27	02/17/98 14:28:57	02/17/98 14:31:25	000:00:02:28
N10C58P44	N100C58P26	02/17/98 14:28:58	02/17/98 14:31:25	000:00:02:27
N10C58P45	N100C58P25	02/17/98 14:28:58	02/17/98 14:31:25	000:00:02:27
N10C58P46	N100C58P24	02/17/98 14:28:58	02/17/98 14:31:25	000:00:02:27
N10C58P24	N100C58P46	02/17/98 14:32:29	02/17/98 14:32:49	000:00:00:20
N10C58P24	N100C58P46	02/17/98 14:33:23	02/17/98 14:33:43	000:00:00:20
:58P25	N100C58P45	02/17/98 14:34:08	02/17/98 14:36:18	000:00:02:10
JC58P26	N100C58P44	02/17/98 14:34:08	02/17/98 14:36:18	000:00:02:10
N10C58P27	N100C58P43	02/17/98 14:34:08	02/17/98 14:36:18	000:00:02:10
N10C58P28	N100C58P42	02/17/98 14:34:09	02/17/98 14:36:18	000:00:02:09
N10C58P29	N100C58P41	02/17/98 14:34:09	02/17/98 14:36:18	000:00:02:09
N10C58P30	N100C58P40	02/17/98 14:34:09	02/17/98 14:36:18	000:00:02:09
N10C58P31	N100C58P39	02/17/98 14:34:11	02/17/98 14:36:19	000:00:02:08
N10C58P32	N100C58P38	02/17/98 14:34:11	02/17/98 14:36:19	000:00:02:08
N10C58P33	N100C58P37	02/17/98 14:34:11	02/17/98 14:36:19	000:00:02:08
N10C58P36	N100C58P34	02/17/98 14:34:13	02/17/98 14:36:21	000:00:02:08
N10C58P37	N100C58P33	02/17/98 14:34:14	02/17/98 14:36:21	000:00:02:07
N10C58P34	N100C58P36	02/17/98 14:34:12	02/17/98 14:36:21	000:00:02:09
N10C58P35	N100C58P35	02/17/98 14:34:12	02/17/98 14:36:21	000:00:02:09
N10C58P38	N100C58P32	02/17/98 14:34:14	02/17/98 14:36:22	000:00:02:08
N10C58P39	N100C58P31	02/17/98 14:34:14	02/17/98 14:36:22	000:00:02:08
N10C58P40	N100C58P30	02/17/98 14:34:15	02/17/98 14:36:22	000:00:02:07
N10C58P41	N100C58P29	02/17/98 14:34:15	02/17/98 14:36:22	000:00:02:07
N10C58P42	N100C58P28	02/17/98 14:34:15	02/17/98 14:36:23	000:00:02:08
N10C58P43	N100C58P27	02/17/98 14:34:16	02/17/98 14:36:23	000:00:02:07
N10C58P44	N100C58P26	02/17/98 14:34:17	02/17/98 14:36:24	000:00:02:07
N10C58P45	N100C58P25	02/17/98 14:34:17	02/17/98 14:36:24	000:00:02:07
N10C58P46	N100C58P24	02/17/98 14:34:17	02/17/98 14:36:24	000:00:02:07
N10C58P24	N100C58P46	02/17/98 14:33:54	02/17/98 14:36:24	000:00:02:30
N10C58P25	N100C58P45	02/17/98 14:38:44	02/17/98 14:41:34	000:00:02:50
N10C58P26	N100C58P44	02/17/98 14:38:45	02/17/98 14:41:34	000:00:02:49
`C58P27	N100C58P43	02/17/98 14:38:45	02/17/98 14:41:34	000:00:02:49
.C58P28	N100C58P42	02/17/98 14:38:45	02/17/98 14:41:34	000:00:02:49
N10C58P29	N100C58P41	02/17/98 14:38:45	02/17/98 14:41:34	000:00:02:49
N10C58P30	N100C58P40	02/17/98 14:38:45	02/17/98 14:41:34	000:00:02:49
N10C58P31	N100C58P39	02/17/98 14:38:47	02/17/98 14:41:35	000:00:02:48
N10C58P32	N100C58P38	02/17/98 14:38:47	02/17/98 14:41:35	000:00:02:48
N10C58P33	N100C58P37	02/17/98 14:38:47	02/17/98 14:41:35	000:00:02:48

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                    Call Duration Report for device N10
                         Mon Feb 23 11:59:41 1998


               From 02/16/98 00:00:00 to 02/23/98 23:59:00


Origination    Termination    Connect Time          Disconnect Time      Duration
Port           Port           mm/dd/yy hh:mm:ss     mm/dd/yy hh:mm:ss     ddd:hh:mm:ss


N10C58P24      N100C58P46     02/17/98 14:38:31     02/17/98 14:41:36     000:00:03:05
N10C58P34      N100C58P36     02/17/98 14:38:48     02/17/98 14:41:36     000:00:02:48
N10C58P35      N100C58P35     02/17/98 14:38:48     02/17/98 14:41:36     000:00:02:48
N10C58P36      N100C58P34     02/17/98 14:38:48     02/17/98 14:41:36     000:00:02:48
N10C58P37      N100C58P33     02/17/98 14:38:49     02/17/98 14:41:36     000:00:02:47
N10C58P38      N100C58P32     02/17/98 14:38:50     02/17/98 14:41:36     000:00:02:46
N10C58P39      N100C58P31     02/17/98 14:38:50     02/17/98 14:41:36     000:00:02:46
N10C58P40      N100C58P30     02/17/98 14:38:51     02/17/98 14:41:36     000:00:02:45
N10C58P41      N100C58P29     02/17/98 14:38:51     02/17/98 14:41:36     000:00:02:45
N10C58P42      N100C58P28     02/17/98 14:38:51     02/17/98 14:41:36     000:00:02:45
N10C58P43      N100C58P27     02/17/98 14:38:52     02/17/98 14:41:36     000:00:02:44
N10C58P44      N100C58P26     02/17/98 14:38:53     02/17/98 14:41:36     000:00:02:43
N10C58P45      N100C58P25     02/17/98 14:38:53     02/17/98 14:41:36     000:00:02:43
N10C58P46      N100C58P24     02/17/98 14:38:53     02/17/98 14:41:36     000:00:02:43
N10C58P24      N100C58P46     02/17/98 14:42:08     02/17/98 14:42:12     000:00:00:04
N10C58P25      N100C58P45     02/17/98 14:43:17     02/17/98 14:44:14     000:00:00:57
N10C58P26      N100C58P44     02/17/98 14:43:17     02/17/98 14:44:15     000:00:00:58
  58P27        N100C58P43     02/17/98 14:43:17     02/17/98 14:44:15     000:00:00:58
  C58P28       N100C58P42     02/17/98 14:43:17     02/17/98 14:44:15     000:00:00:58
N10C58P29      N100C58P41     02/17/98 14:43:17     02/17/98 14:44:15     000:00:00:58
N10C58P30      N100C58P40     02/17/98 14:43:18     02/17/98 14:44:15     000:00:00:57
N10C58P31      N100C58P39     02/17/98 14:43:19     02/17/98 14:44:15     000:00:00:56
N10C58P32      N100C58P38     02/17/98 14:43:20     02/17/98 14:44:17     000:00:00:57
N10C58P33      N100C58P37     02/17/98 14:43:20     02/17/98 14:44:17     000:00:00:57
N10C58P34      N100C58P36     02/17/98 14:43:21     02/17/98 14:44:17     000:00:00:56
N10C58P35      N100C58P35     02/17/98 14:43:21     02/17/98 14:44:17     000:00:00:56
N10C58P37      N100C58P33     02/17/98 14:43:22     02/17/98 14:44:18     000:00:00:56
N10C58P36      N100C58P34     02/17/98 14:43:20     02/17/98 14:44:18     000:00:00:58
N10C58P38      N100C58P32     02/17/98 14:43:22     02/17/98 14:44:18     000:00:00:56
N10C58P39      N100C58P31     02/17/98 14:43:23     02/17/98 14:44:19     000:00:00:56
N10C58P40      N100C58P30     02/17/98 14:43:23     02/17/98 14:44:19     000:00:00:56
N10C58P41      N100C58P29     02/17/98 14:43:23     02/17/98 14:44:20     000:00:00:57
N10C58P42      N100C58P28     02/17/98 14:43:23     02/17/98 14:44:20     000:00:00:57
N10C58P43      N100C58P27     02/17/98 14:43:25     02/17/98 14:44:20     000:00:00:55
N10C58P44      N100C58P26     02/17/98 14:43:25     02/17/98 14:44:20     000:00:00:55
N10C58P45      N100C58P25     02/17/98 14:43:26     02/17/98 14:44:21     000:00:00:55
N10C58P46      N100C58P24     02/17/98 14:43:26     02/17/98 14:44:21     000:00:00:55
N10C58P24      N100C58P46     02/17/98 14:43:03     02/17/98 14:44:21     000:00:01:18
N10C58P25      N100C58P45     02/17/98 15:10:27     02/17/98 15:18:33     000:00:08:06
N10C58P26      N100C58P44     02/17/98 15:10:27     02/17/98 15:18:33     000:00:08:06
N10C58P27      N100C58P43     02/17/98 15:10:28     02/17/98 15:18:34     000:00:08:06
N10C58P28      N100C58P42     02/17/98 15:10:28     02/17/98 15:18:34     000:00:08:06
  0C58P29      N100C58P41     02/17/98 15:10:28     02/17/98 15:18:34     000:00:08:06
   58P30       N100C58P40     02/17/98 15:10:28     02/17/98 15:18:34     000:00:08:06
  10C58P31     N100C58P39     02/17/98 15:10:30     02/17/98 15:18:34     000:00:08:04
N10C58P32      N100C58P38     02/17/98 15:10:30     02/17/98 15:18:34     000:00:08:04
N10C58P33      N100C58P37     02/17/98 15:10:30     02/17/98 15:18:35     000:00:08:05
N10C58P34      N100C58P36     02/17/98 15:10:31     02/17/98 15:18:35     000:00:08:04
N10C58P35      N100C58P35     02/17/98 15:10:31     02/17/98 15:18:35     000:00:08:04
```

Call Duration Report for device N10
Mon Feb 23 11:59:41 1998

From 02/16/98 00:00:00 to 02/23/98 23:59:00

Origination Port	Termination Port	Connect Time mm/dd/yy hh:mm:ss	Disconnect Time mm/dd/yy hh:mm:ss	Duration ddd:hh:mm:ss
N10C58P36	N100C58P34	02/17/98 15:10:31	02/17/98 15:18:35	000:00:08:04
N10C58P37	N100C58P33	02/17/98 15:10:32	02/17/98 15:18:35	000:00:08:03
N10C58P38	N100C58P32	02/17/98 15:10:33	02/17/98 15:18:36	000:00:08:03
N10C58P39	N100C58P31	02/17/98 15:10:33	02/17/98 15:18:36	000:00:08:03
N10C58P40	N100C58P30	02/17/98 15:10:33	02/17/98 15:18:36	000:00:08:03
N10C58P41	N100C58P29	02/17/98 15:10:33	02/17/98 15:18:36	000:00:08:03
N10C58P42	N100C58P28	02/17/98 15:10:34	02/17/98 15:18:37	000:00:08:03
N10C58P43	N100C58P27	02/17/98 15:10:35	02/17/98 15:18:37	000:00:08:02
N10C58P44	N100C58P26	02/17/98 15:10:36	02/17/98 15:18:38	000:00:08:02
N10C58P45	N100C58P25	02/17/98 15:10:36	02/17/98 15:18:38	000:00:08:02
N10C58P46	N100C58P24	02/17/98 15:10:36	02/17/98 15:18:38	000:00:08:02
N10C58P24	N100C58P46	02/17/98 15:10:14	02/17/98 15:18:39	000:00:08:25
N10C25P41	N8C26P6	02/17/98 06:28:53	02/17/98 15:23:38	000:08:54:45
N10C25P42	N8C26P5	02/17/98 06:28:53	02/17/98 15:23:38	000:08:54:45
N10C25P43	N8C26P4	02/17/98 06:28:53	02/17/98 15:23:39	000:08:54:46
N10C25P44	N8C26P3	02/17/98 06:28:53	02/17/98 15:23:39	000:08:54:46
N10C25P45	N8C26P2	02/17/98 06:28:52	02/17/98 15:23:39	000:08:54:47
`C25P46	N8C26P24	02/17/98 06:28:45	02/17/98 15:23:39	000:08:54:54
JC58P25	N100C58P45	02/17/98 16:21:25	02/17/98 16:23:42	000:00:02:17
N10C58P26	N100C58P44	02/17/98 16:21:25	02/17/98 16:23:42	000:00:02:17
N10C58P27	N100C58P43	02/17/98 16:21:25	02/17/98 16:23:42	000:00:02:17
N10C58P28	N100C58P42	02/17/98 16:21:25	02/17/98 16:23:42	000:00:02:17
N10C58P29	N100C58P41	02/17/98 16:21:25	02/17/98 16:23:42	000:00:02:17
N10C58P30	N100C58P40	02/17/98 16:21:25	02/17/98 16:23:42	000:00:02:17
N10C58P31	N100C58P39	02/17/98 16:21:27	02/17/98 16:23:42	000:00:02:15
N10C58P32	N100C58P38	02/17/98 16:21:28	02/17/98 16:23:43	000:00:02:15
N10C58P33	N100C58P37	02/17/98 16:21:28	02/17/98 16:23:43	000:00:02:15
N10C58P34	N100C58P36	02/17/98 16:21:28	02/17/98 16:23:43	000:00:02:15
N10C58P35	N100C58P35	02/17/98 16:21:29	02/17/98 16:23:43	000:00:02:14
N10C58P36	N100C58P34	02/17/98 16:21:29	02/17/98 16:23:43	000:00:02:14
N10C58P37	N100C58P33	02/17/98 16:21:31	02/17/98 16:23:44	000:00:02:13
N10C58P38	N100C58P32	02/17/98 16:21:31	02/17/98 16:23:44	000:00:02:13
N10C58P39	N100C58P31	02/17/98 16:21:31	02/17/98 16:23:44	000:00:02:13
N10C58P40	N100C58P30	02/17/98 16:21:31	02/17/98 16:23:44	000:00:02:13
N10C58P41	N100C58P29	02/17/98 16:21:32	02/17/98 16:23:45	000:00:02:13
N10C58P42	N100C58P28	02/17/98 16:21:32	02/17/98 16:23:45	000:00:02:13
N10C58P43	N100C58P27	02/17/98 16:21:33	02/17/98 16:23:45	000:00:02:12
N10C58P44	N100C58P26	02/17/98 16:21:33	02/17/98 16:23:45	000:00:02:12
N10C58P45	N100C58P25	02/17/98 16:21:34	02/17/98 16:23:46	000:00:02:12
N10C58P46	N100C58P24	02/17/98 16:21:34	02/17/98 16:23:46	000:00:02:12
N10C58P24	N100C58P46	02/17/98 16:21:11	02/17/98 16:23:47	000:00:02:36
N10C55P3	N14C10P0	02/12/98 07:37:45	02/17/98 17:03:24	005:09:25:39
''10C27P3	N14C22P0	02/12/98 07:37:25	02/17/98 17:03:36	005:09:26:11
C58P26	N100C58P45	02/17/98 18:12:59	02/17/98 18:15:35	000:00:02:36
N10C58P27	N100C58P44	02/17/98 18:13:00	02/17/98 18:15:36	000:00:02:36
N10C58P28	N100C58P43	02/17/98 18:13:00	02/17/98 18:15:36	000:00:02:36
N10C58P29	N100C58P42	02/17/98 18:13:00	02/17/98 18:15:36	000:00:02:36
N10C58P30	N100C58P41	02/17/98 18:13:00	02/17/98 18:15:36	000:00:02:36
N10C58P31	N100C58P40	02/17/98 18:13:00	02/17/98 18:15:36	000:00:02:36

Call Duration Report for device N10
Mon Feb 23 11:59:41 1998

From 02/16/98 00:00:00 to 02/23/98 23:59:00

Origination Port	Termination Port	Connect Time mm/dd/yy hh:mm:ss	Disconnect Time mm/dd/yy hh:mm:ss	Duration ddd:hh:mm:ss
N10C58P32	N100C58P39	02/17/98 18:13:01	02/17/98 18:15:37	000:00:02:36
N10C58P33	N100C58P38	02/17/98 18:13:02	02/17/98 18:15:37	000:00:02:35
N10C58P34	N100C58P37	02/17/98 18:13:02	02/17/98 18:15:37	000:00:02:35
N10C58P35	N100C58P36	02/17/98 18:13:03	02/17/98 18:15:38	000:00:02:35
N10C58P36	N100C58P35	02/17/98 18:13:03	02/17/98 18:15:38	000:00:02:35
N10C58P37	N100C58P34	02/17/98 18:13:03	02/17/98 18:15:38	000:00:02:35
N10C58P38	N100C58P33	02/17/98 18:13:04	02/17/98 18:15:38	000:00:02:34
N10C58P39	N100C58P32	02/17/98 18:13:05	02/17/98 18:15:39	000:00:02:34
N10C58P40	N100C58P31	02/17/98 18:13:05	02/17/98 18:15:39	000:00:02:34
N10C58P41	N100C58P30	02/17/98 18:13:05	02/17/98 18:15:39	000:00:02:34
N10C58P42	N100C58P29	02/17/98 18:13:06	02/17/98 18:15:40	000:00:02:34
N10C58P43	N100C58P28	02/17/98 18:13:06	02/17/98 18:15:40	000:00:02:34
N10C58P44	N100C58P27	02/17/98 18:13:07	02/17/98 18:15:40	000:00:02:33
N10C58P45	N100C58P26	02/17/98 18:13:08	02/17/98 18:15:41	000:00:02:33
N10C58P46	N100C58P25	02/17/98 18:13:08	02/17/98 18:15:41	000:00:02:33
N10C58P25	N100C58P46	02/17/98 18:12:45	02/17/98 18:15:41	000:00:02:56
N10C58P26	N100C58P45	02/18/98 00:57:47	02/18/98 01:00:30	000:00:02:43
)C58P27	N100C58P44	02/18/98 00:57:47	02/18/98 01:00:30	000:00:02:43
₁0C58P28	N100C58P43	02/18/98 00:57:47	02/18/98 01:00:30	000:00:02:43
N10C58P29	N100C58P42	02/18/98 00:57:47	02/18/98 01:00:30	000:00:02:43
N10C58P30	N100C58P41	02/18/98 00:57:47	02/18/98 01:00:30	000:00:02:43
N10C58P31	N100C58P40	02/18/98 00:57:47	02/18/98 01:00:30	000:00:02:43
N10C58P32	N100C58P39	02/18/98 00:57:49	02/18/98 01:00:30	000:00:02:41
N10C58P33	N100C58P38	02/18/98 00:57:50	02/18/98 01:00:31	000:00:02:41
N10C58P34	N100C58P37	02/18/98 00:57:50	02/18/98 01:00:31	000:00:02:41
N10C58P35	N100C58P36	02/18/98 00:57:50	02/18/98 01:00:31	000:00:02:41
N10C58P36	N100C58P35	02/18/98 00:57:50	02/18/98 01:00:31	000:00:02:41
N10C58P37	N100C58P34	02/18/98 00:57:50	02/18/98 01:00:31	000:00:02:41
N10C58P38	N100C58P33	02/18/98 00:57:52	02/18/98 01:00:32	000:00:02:40
N10C58P39	N100C58P32	02/18/98 00:57:53	02/18/98 01:00:32	000:00:02:39
N10C58P40	N100C58P31	02/18/98 00:57:53	02/18/98 01:00:32	000:00:02:39
N10C58P41	N100C58P30	02/18/98 00:57:53	02/18/98 01:00:32	000:00:02:39
N10C58P42	N100C58P29	02/18/98 00:57:54	02/18/98 01:00:33	000:00:02:39
N10C58P43	N100C58P28	02/18/98 00:57:54	02/18/98 01:00:33	000:00:02:39
N10C58P44	N100C58P27	02/18/98 00:57:55	02/18/98 01:00:33	000:00:02:38
N10C58P45	N100C58P26	02/18/98 00:57:56	02/18/98 01:00:34	000:00:02:38
N10C58P46	N100C58P25	02/18/98 00:57:56	02/18/98 01:00:34	000:00:02:38
N10C58P25	N100C58P46	02/18/98 00:57:33	02/18/98 01:00:34	000:00:03:01
N10C25P41	N8C26P30	02/18/98 06:33:24	02/18/98 06:33:44	000:00:00:20
N10C25P42	N8C26P29	02/18/98 06:33:24	02/18/98 06:33:44	000:00:00:20
N10C25P43	N8C26P28	02/18/98 06:33:24	02/18/98 06:33:45	000:00:00:21
N10C25P44	N8C26P27	02/18/98 06:33:24	02/18/98 06:33:45	000:00:00:21
₁C25P45	N8C26P26	02/18/98 06:33:24	02/18/98 06:33:45	000:00:00:21
JC25P46	N8C26P25	02/18/98 06:33:17	02/18/98 06:33:45	000:00:00:28
N10C25P41	N8C26P30	02/18/98 06:34:21	02/18/98 06:59:28	000:00:25:07
N10C25P42	N8C26P29	02/18/98 06:34:21	02/18/98 06:59:29	000:00:25:08
N10C25P43	N8C26P28	02/18/98 06:34:20	02/18/98 06:59:29	000:00:25:09
N10C25P44	N8C26P27	02/18/98 06:34:20	02/18/98 06:59:29	000:00:25:09
N10C25P45	N8C26P26	02/18/98 06:34:20	02/18/98 06:59:29	000:00:25:09

Call Duration Report for device N10
Mon Feb 23 11:59:41 1998

From 02/16/98 00:00:00 to 02/23/98 23:59:00

Origination Port	Termination Port	Connect Time mm/dd/yy hh:mm:ss	Disconnect Time mm/dd/yy hh:mm:ss	Duration ddd:hh:mm:ss
N10C25P46	N8C26P25	02/18/98 06:34:12	02/18/98 06:59:29	000:00:25:17
N10C25P41	N8C26P36	02/18/98 07:00:10	02/18/98 07:05:33	000:00:05:23
N10C25P42	N8C26P35	02/18/98 07:00:11	02/18/98 07:05:34	000:00:05:23
N10C25P43	N8C26P34	02/18/98 07:00:10	02/18/98 07:05:34	000:00:05:24
N10C25P44	N8C26P33	02/18/98 07:00:10	02/18/98 07:05:34	000:00:05:24
N10C25P45	N8C26P32	02/18/98 07:00:09	02/18/98 07:05:34	000:00:05:25
N10C25P46	N8C26P31	02/18/98 07:00:02	02/18/98 07:05:34	000:00:05:32
N10C25P41	N8C26P31	02/18/98 07:05:57	02/18/98 07:06:17	000:00:00:20
N10C25P42	N8C26P30	02/18/98 07:05:56	02/18/98 07:06:17	000:00:00:21
N10C25P43	N8C26P29	02/18/98 07:05:56	02/18/98 07:06:17	000:00:00:21
N10C25P44	N8C26P28	02/18/98 07:05:55	02/18/98 07:06:17	000:00:00:22
N10C25P45	N8C26P27	02/18/98 07:05:56	02/18/98 07:06:18	000:00:00:22
N10C25P46	N8C26P25	02/18/98 07:05:49	02/18/98 07:06:18	000:00:00:29
N10C25P41	N8C26P31	02/18/98 07:06:41	02/18/98 07:07:12	000:00:00:31
N10C25P42	N8C26P30	02/18/98 07:06:41	02/18/98 07:07:12	000:00:00:31
N10C25P43	N8C26P29	02/18/98 07:06:40	02/18/98 07:07:12	000:00:00:32
N10C25P44	N8C26P28	02/18/98 07:06:39	02/18/98 07:07:12	000:00:00:33
?C25P45	N8C26P27	02/18/98 07:06:39	02/18/98 07:07:12	000:00:00:33
,0C25P46	N8C26P25	02/18/98 07:06:32	02/18/98 07:07:12	000:00:00:40
N10C25P41	N8C26P43	02/18/98 07:07:33	02/18/98 07:07:52	000:00:00:19
N10C25P42	N8C26P35	02/18/98 07:07:32	02/18/98 07:07:52	000:00:00:20
N10C25P43	N8C26P33	02/18/98 07:07:32	02/18/98 07:07:52	000:00:00:20
N10C25P44	N8C26P31	02/18/98 07:07:31	02/18/98 07:07:52	000:00:00:21
N10C25P45	N8C26P29	02/18/98 07:07:31	02/18/98 07:07:52	000:00:00:21
N10C25P46	N8C26P26	02/18/98 07:07:24	02/18/98 07:07:52	000:00:00:28
N10C25P40	N100C57P0	02/18/98 06:46:28	02/18/98 07:52:10	000:01:05:42
N10C25P35	N100C57P5	02/18/98 06:46:30	02/18/98 07:52:10	000:01:05:40
N10C25P36	N100C57P4	02/18/98 06:46:30	02/18/98 07:52:10	000:01:05:40
N10C25P37	N100C57P3	02/18/98 06:46:29	02/18/98 07:52:10	000:01:05:41
N10C25P38	N100C57P2	02/18/98 06:46:30	02/18/98 07:52:11	000:01:05:41
N10C25P39	N100C57P1	02/18/98 06:46:29	02/18/98 07:52:11	000:01:05:42
N10C25P41	N8C26P43	02/18/98 07:08:53	02/18/98 08:32:09	000:01:23:16
N10C25P42	N8C26P35	02/18/98 07:08:52	02/18/98 08:32:09	000:01:23:17
N10C25P43	N8C26P33	02/18/98 07:08:52	02/18/98 08:32:09	000:01:23:17
N10C25P44	N8C26P31	02/18/98 07:08:51	02/18/98 08:32:09	000:01:23:18
N10C25P45	N8C26P29	02/18/98 07:08:52	02/18/98 08:32:10	000:01:23:18
N10C25P46	N8C26P26	02/18/98 07:08:45	02/18/98 08:32:10	000:01:23:25
N10C25P41	N8C26P35	02/18/98 08:32:37	02/18/98 08:32:55	000:00:00:18
N10C25P42	N8C26P33	02/18/98 08:32:36	02/18/98 08:32:55	000:00:00:19
N10C25P43	N8C26P31	02/18/98 08:32:36	02/18/98 08:32:55	000:00:00:19
N10C25P44	N8C26P29	02/18/98 08:32:35	02/18/98 08:32:55	000:00:00:20
N10C25P45	N8C26P27	02/18/98 08:32:35	02/18/98 08:32:55	000:00:00:20
?0C25P46	N8C26P10	02/18/98 08:32:28	02/18/98 08:32:55	000:00:00:27
JC25P0	N11C26P24	02/12/98 12:47:37	02/18/98 08:51:58	005:20:04:21
N10C25P41	N8C26P33	02/18/98 08:34:19	02/18/98 09:00:30	000:00:26:11
N10C25P42	N8C26P29	02/18/98 08:34:20	02/18/98 09:00:31	000:00:26:11
N10C25P43	N8C26P26	02/18/98 08:34:19	02/18/98 09:00:31	000:00:26:12
N10C25P44	N8C26P22	02/18/98 08:34:19	02/18/98 09:00:31	000:00:26:12
N10C25P45	N8C26P18	02/18/98 08:34:18	02/18/98 09:00:31	000:00:26:13

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                    Call Duration Report for device N10
                         Mon Feb 23 11:59:41 1998

                 From 02/16/98 00:00:00 to 02/23/98 23:59:00


    Origination    Termination    Connect Time        Disconnect Time      Duration
    Port           Port           mm/dd/yy hh:mm:ss    mm/dd/yy hh:mm:ss    ddd:hh:mm:ss


    N10C25P46      N8C26P10       02/18/98 08:34:11    02/18/98 09:00:31    000:00:26:20
    N10C25P41      N8C26P16       02/18/98 09:00:50    02/18/98 09:01:10    000:00:00:20
    N10C25P42      N8C26P15       02/18/98 09:00:50    02/18/98 09:01:10    000:00:00:20
    N10C25P43      N8C26P14       02/18/98 09:00:49    02/18/98 09:01:10    000:00:00:21
    N10C25P44      N8C26P13       02/18/98 09:00:49    02/18/98 09:01:10    000:00:00:21
    N10C25P45      N8C26P11       02/18/98 09:00:48    02/18/98 09:01:10    000:00:00:22
    N10C25P46      N8C26P9        02/18/98 09:00:41    02/18/98 09:01:10    000:00:00:29
    N10C25P41      N8C26P15       02/18/98 09:01:29    02/18/98 09:17:12    000:00:15:43
    N10C25P42      N8C26P14       02/18/98 09:01:29    02/18/98 09:17:13    000:00:15:44
    N10C25P43      N8C26P13       02/18/98 09:01:28    02/18/98 09:17:13    000:00:15:45
    N10C25P44      N8C26P12       02/18/98 09:01:28    02/18/98 09:17:13    000:00:15:45
    N10C25P45      N8C26P11       02/18/98 09:01:28    02/18/98 09:17:13    000:00:15:45
    N10C25P46      N8C26P9        02/18/98 09:01:20    02/18/98 09:17:13    000:00:15:53
    N10C25P41      N8C26P27       02/18/98 09:17:38    02/18/98 12:12:35    000:02:54:57
    N10C25P42      N8C26P26       02/18/98 09:17:39    02/18/98 12:12:36    000:02:54:57
    N10C25P43      N8C26P22       02/18/98 09:17:38    02/18/98 12:12:36    000:02:54:58
    N10C25P44      N8C26P20       02/18/98 09:17:38    02/18/98 12:12:36    000:02:54:58
    'C25P45        N8C26P18       02/18/98 09:17:37    02/18/98 12:12:36    000:02:54:59
    JC25P46        N8C26P10       02/18/98 09:17:30    02/18/98 12:12:36    000:02:55:06
    N10C25P41      N8C26P27       02/18/98 12:15:11    02/18/98 12:21:29    000:00:06:18
    N10C25P42      N8C26P26       02/18/98 12:15:10    02/18/98 12:21:29    000:00:06:19
    N10C25P43      N8C26P22       02/18/98 12:15:10    02/18/98 12:21:29    000:00:06:19
    N10C25P44      N8C26P20       02/18/98 12:15:09    02/18/98 12:21:29    000:00:06:20
    N10C25P45      N8C26P18       02/18/98 12:15:10    02/18/98 12:21:30    000:00:06:20
    N10C25P46      N8C26P10       02/18/98 12:15:03    02/18/98 12:21:30    000:00:06:27
    N10C25P46      N8C26P10       02/18/98 12:22:06    02/18/98 12:23:04    000:00:00:58
    N10C25P45      N8C26P18       02/18/98 12:22:22    02/18/98 12:23:04    000:00:00:42
    N10C58P26      N100C58P45     02/18/98 11:55:14    02/18/98 12:32:36    000:00:37:22
    N10C58P27      N100C58P44     02/18/98 11:55:15    02/18/98 12:32:37    000:00:37:22
    N10C58P28      N100C58P43     02/18/98 11:55:15    02/18/98 12:32:37    000:00:37:22
    N10C58P29      N100C58P42     02/18/98 11:55:15    02/18/98 12:32:37    000:00:37:22
    N10C58P30      N100C58P41     02/18/98 11:55:15    02/18/98 12:32:37    000:00:37:22
    N10C58P31      N100C58P40     02/18/98 11:55:15    02/18/98 12:32:37    000:00:37:22
    N10C58P32      N100C58P39     02/18/98 11:55:17    02/18/98 12:32:38    000:00:37:21
    N10C58P33      N100C58P38     02/18/98 11:55:18    02/18/98 12:32:39    000:00:37:21
    N10C58P34      N100C58P37     02/18/98 11:55:18    02/18/98 12:32:39    000:00:37:21
    N10C58P35      N100C58P36     02/18/98 11:55:18    02/18/98 12:32:39    000:00:37:21
    N10C58P36      N100C58P35     02/18/98 11:55:18    02/18/98 12:32:39    000:00:37:21
    N10C58P37      N100C58P34     02/18/98 11:55:19    02/18/98 12:32:40    000:00:37:21
    N10C58P38      N100C58P33     02/18/98 11:55:20    02/18/98 12:32:40    000:00:37:20
    N10C58P39      N100C58P32     02/18/98 11:55:20    02/18/98 12:32:40    000:00:37:20
    N10C58P40      N100C58P31     02/18/98 11:55:21    02/18/98 12:32:40    000:00:37:19
    'C58P41        N100C58P30     02/18/98 11:55:22    02/18/98 12:32:41    000:00:37:19
    C58P42         N100C58P29     02/18/98 11:55:22    02/18/98 12:32:41    000:00:37:19
    10C58P43       N100C58P28     02/18/98 11:55:22    02/18/98 12:32:41    000:00:37:19
    N10C58P44      N100C58P27     02/18/98 11:55:22    02/18/98 12:32:41    000:00:37:19
    N10C58P45      N100C58P26     02/18/98 11:55:23    02/18/98 12:32:41    000:00:37:18
    N10C58P46      N100C58P25     02/18/98 11:55:23    02/18/98 12:32:42    000:00:37:19
    N10C58P25      N100C58P46     02/18/98 11:55:00    02/18/98 12:32:42    000:00:37:42
```

Call Duration Report for device N10
Mon Feb 23 11:59:41 1998

From 02/16/98 00:00:00 to 02/23/98 23:59:00

Origination Port	Termination Port	Connect Time mm/dd/yy hh:mm:ss	Disconnect Time mm/dd/yy hh:mm:ss	Duration ddd:hh:mm:ss
N10C58P25	N100C58P46	02/18/98 12:32:50	02/18/98 12:33:10	000:00:00:20
N10C58P26	N100C58P45	02/18/98 12:38:19	02/18/98 12:45:08	000:00:06:49
N10C58P27	N100C58P44	02/18/98 12:38:19	02/18/98 12:45:08	000:00:06:49
N10C58P28	N100C58P43	02/18/98 12:38:19	02/18/98 12:45:08	000:00:06:49
N10C58P29	N100C58P42	02/18/98 12:38:20	02/18/98 12:45:09	000:00:06:49
N10C58P30	N100C58P41	02/18/98 12:38:20	02/18/98 12:45:09	000:00:06:49
N10C58P31	N100C58P40	02/18/98 12:38:20	02/18/98 12:45:09	000:00:06:49
N10C58P32	N100C58P39	02/18/98 12:38:22	02/18/98 12:45:09	000:00:06:47
N10C58P33	N100C58P38	02/18/98 12:38:22	02/18/98 12:45:09	000:00:06:47
N10C58P34	N100C58P37	02/18/98 12:38:22	02/18/98 12:45:09	000:00:06:47
N10C58P35	N100C58P36	02/18/98 12:38:22	02/18/98 12:45:09	000:00:06:47
N10C58P36	N100C58P35	02/18/98 12:38:23	02/18/98 12:45:10	000:00:06:47
N10C58P37	N100C58P34	02/18/98 12:38:23	02/18/98 12:45:10	000:00:06:47
N10C58P38	N100C58P33	02/18/98 12:38:25	02/18/98 12:45:11	000:00:06:46
N10C58P39	N100C58P32	02/18/98 12:38:25	02/18/98 12:45:11	000:00:06:46
N10C58P40	N100C58P31	02/18/98 12:38:25	02/18/98 12:45:11	000:00:06:46
N10C58P41	N100C58P30	02/18/98 12:38:26	02/18/98 12:45:12	000:00:06:46
C58P42	N100C58P29	02/18/98 12:38:26	02/18/98 12:45:12	000:00:06:46
JC58P43	N100C58P28	02/18/98 12:38:27	02/18/98 12:45:13	000:00:06:46
N10C58P44	N100C58P27	02/18/98 12:38:27	02/18/98 12:45:13	000:00:06:46
N10C58P45	N100C58P26	02/18/98 12:38:27	02/18/98 12:45:13	000:00:06:46
N10C58P46	N100C58P25	02/18/98 12:38:28	02/18/98 12:45:13	000:00:06:45
N10C58P25	N100C58P46	02/18/98 12:38:05	02/18/98 12:45:13	000:00:07:08
N10C25P0	N11C26P24	02/18/98 08:55:29	02/18/98 12:54:17	000:03:58:48
N10C58P26	N100C58P45	02/18/98 13:20:02	02/18/98 13:30:01	000:00:09:59
N10C58P27	N100C58P44	02/18/98 13:20:02	02/18/98 13:30:02	000:00:10:00
N10C58P28	N100C58P43	02/18/98 13:20:02	02/18/98 13:30:02	000:00:10:00
N10C58P29	N100C58P42	02/18/98 13:20:03	02/18/98 13:30:02	000:00:09:59
N10C58P30	N100C58P41	02/18/98 13:20:03	02/18/98 13:30:02	000:00:09:59
N10C58P31	N100C58P40	02/18/98 13:20:03	02/18/98 13:30:02	000:00:09:59
N10C58P32	N100C58P39	02/18/98 13:20:04	02/18/98 13:30:02	000:00:09:58
N10C58P33	N100C58P38	02/18/98 13:20:05	02/18/98 13:30:04	000:00:09:59
N10C58P34	N100C58P37	02/18/98 13:20:05	02/18/98 13:30:04	000:00:09:59
N10C58P35	N100C58P36	02/18/98 13:20:06	02/18/98 13:30:04	000:00:09:58
N10C58P36	N100C58P35	02/18/98 13:20:06	02/18/98 13:30:04	000:00:09:58
N10C58P37	N100C58P34	02/18/98 13:20:06	02/18/98 13:30:04	000:00:09:58
N10C58P38	N100C58P33	02/18/98 13:20:07	02/18/98 13:30:04	000:00:09:57
N10C58P39	N100C58P32	02/18/98 13:20:08	02/18/98 13:30:05	000:00:09:57
N10C58P40	N100C58P31	02/18/98 13:20:08	02/18/98 13:30:06	000:00:09:58
N10C58P41	N100C58P30	02/18/98 13:20:09	02/18/98 13:30:07	000:00:09:58
N10C58P42	N100C58P29	02/18/98 13:20:09	02/18/98 13:30:07	000:00:09:58
N10C58P43	N100C58P28	02/18/98 13:20:10	02/18/98 13:30:08	000:00:09:58
0C58P44	N100C58P27	02/18/98 13:20:10	02/18/98 13:30:08	000:00:09:58
C58P45	N100C58P26	02/18/98 13:20:10	02/18/98 13:30:08	000:00:09:58
N10C58P46	N100C58P25	02/18/98 13:20:11	02/18/98 13:30:08	000:00:09:57
N10C58P25	N100C58P46	02/18/98 13:19:48	02/18/98 13:30:08	000:00:10:20
N10C25P35	N8C26P17	02/18/98 14:27:29	02/18/98 14:28:55	000:00:01:26
N10C25P36	N8C26P16	02/18/98 14:27:28	02/18/98 14:28:55	000:00:01:27
N10C25P37	N8C26P7	02/18/98 14:27:27	02/18/98 14:28:55	000:00:01:28

Call Duration Report for device N10
Mon Feb 23 11:59:41 1998

From 02/16/98 00:00:00 to 02/23/98 23:59:00

Origination Port	Termination Port	Connect Time mm/dd/yy hh:mm:ss	Disconnect Time mm/dd/yy hh:mm:ss	Duration ddd:hh:mm:ss
N10C25P38	N8C26P6	02/18/98 14:27:28	02/18/98 14:28:56	000:00:01:28
N10C25P39	N8C26P4	02/18/98 14:27:27	02/18/98 14:28:56	000:00:01:29
N10c25P40	N8C26P3	02/18/98 14:27:24	02/18/98 14:28:56	000:00:01:32
N10C25P41	N8C26P27	02/18/98 12:24:47	02/18/98 15:28:04	000:03:03:17
N10C25P42	N8C26P26	02/18/98 12:24:46	02/18/98 15:28:04	000:03:03:18
N10C25P43	N8C26P22	02/18/98 12:24:47	02/18/98 15:28:05	000:03:03:18
N10C25P44	N8C26P20	02/18/98 12:24:46	02/18/98 15:28:05	000:03:03:19
N10C25P45	N8C26P18	02/18/98 12:24:45	02/18/98 15:28:05	000:03:03:20
N10C25P46	N8C26P10	02/18/98 12:24:38	02/18/98 15:28:05	000:03:03:27
N10C25P46	N8C26P0	02/18/98 15:28:18	02/18/98 15:28:18	000:00:00:00
N10C25P46	N8C26P0	02/18/98 15:28:42	02/18/98 15:28:42	000:00:00:00
N10C58P47	N10C43P5	02/10/98 07:59:53	02/18/98 16:11:12	008:08:11:19
N10C25P35	N8C26P17	02/18/98 14:30:46	02/18/98 17:08:33	000:02:37:47
N10C25P36	N8C26P16	02/18/98 14:30:45	02/18/98 17:08:33	000:02:37:48
N10C25P37	N8C26P7	02/18/98 14:30:44	02/18/98 17:08:33	000:02:37:49
N10C25P38	N8C26P6	02/18/98 14:30:45	02/18/98 17:08:34	000:02:37:49
N10C25P39	N8C26P4	02/18/98 14:30:44	02/18/98 17:08:34	000:02:37:50
'25P40	N8C26P3	02/18/98 14:30:42	02/18/98 17:08:34	000:02:37:52
.C58P25	N100C58P45	02/19/98 00:57:49	02/19/98 01:00:20	000:00:02:31
N10C58P26	N100C58P44	02/19/98 00:57:49	02/19/98 01:00:20	000:00:02:31
N10C58P27	N100C58P43	02/19/98 00:57:49	02/19/98 01:00:20	000:00:02:31
N10C58P28	N100C58P42	02/19/98 00:57:49	02/19/98 01:00:20	000:00:02:31
N10C58P29	N100C58P41	02/19/98 00:57:49	02/19/98 01:00:20	000:00:02:31
N10C58P30	N100C58P40	02/19/98 00:57:49	02/19/98 01:00:20	000:00:02:31
N10C58P31	N100C58P39	02/19/98 00:57:52	02/19/98 01:00:21	000:00:02:29
N10C58P32	N100C58P38	02/19/98 00:57:51	02/19/98 01:00:21	000:00:02:30
N10C58P33	N100C58P37	02/19/98 00:57:53	02/19/98 01:00:22	000:00:02:29
N10C58P34	N100C58P36	02/19/98 00:57:53	02/19/98 01:00:22	000:00:02:29
N10C58P35	N100C58P35	02/19/98 00:57:53	02/19/98 01:00:22	000:00:02:29
N10C58P36	N100C58P34	02/19/98 00:57:53	02/19/98 01:00:22	000:00:02:29
N10C58P37	N100C58P33	02/19/98 00:57:55	02/19/98 01:00:22	000:00:02:27
N10C58P38	N100C58P32	02/19/98 00:57:55	02/19/98 01:00:23	000:00:02:28
N10C58P39	N100C58P31	02/19/98 00:57:55	02/19/98 01:00:23	000:00:02:28
N10C58P40	N100C58P30	02/19/98 00:57:56	02/19/98 01:00:23	000:00:02:27
N10C58P41	N100C58P29	02/19/98 00:57:56	02/19/98 01:00:23	000:00:02:27
N10C58P42	N100C58P28	02/19/98 00:57:56	02/19/98 01:00:24	000:00:02:28
N10C58P43	N100C58P27	02/19/98 00:57:58	02/19/98 01:00:24	000:00:02:26
N10C58P44	N100C58P26	02/19/98 00:57:58	02/19/98 01:00:24	000:00:02:26
N10C58P45	N100C58P25	02/19/98 00:57:58	02/19/98 01:00:24	000:00:02:26
N10C58P46	N100C58P24	02/19/98 00:57:58	02/19/98 01:00:24	000:00:02:26
N10C58P24	N100C58P46	02/19/98 00:57:36	02/19/98 01:00:25	000:00:02:49
N10C25P41	N8C26P28	02/19/98 06:33:02	02/19/98 06:33:23	000:00:00:21
·25P42	N8C26P27	02/19/98 06:33:03	02/19/98 06:33:24	000:00:00:21
.25P43	N8C26P26	02/19/98 06:33:02	02/19/98 06:33:24	000:00:00:22
N10C25P44	N8C26P25	02/19/98 06:33:01	02/19/98 06:33:24	000:00:00:23
N10C25P45	N8C26P24	02/19/98 06:33:01	02/19/98 06:33:24	000:00:00:23
N10C25P46	N8C26P10	02/19/98 06:32:54	02/19/98 06:33:24	000:00:00:30
N10C25P41	N8C26P29	02/19/98 06:33:47	02/19/98 06:34:07	000:00:00:20
N10C25P42	N8C26P28	02/19/98 06:33:47	02/19/98 06:34:08	000:00:00:21

Call Duration Report for device N10
Mon Feb 23 11:59:41 1998

From 02/16/98 00:00:00 to 02/23/98 23:59:00

Origination Port	Termination Port	Connect Time mm/dd/yy hh:mm:ss	Disconnect Time mm/dd/yy hh:mm:ss	Duration ddd:hh:mm:ss
N10C25P43	N8C26P27	02/19/98 06:33:47	02/19/98 06:34:08	000:00:00:21
N10C25P44	N8C26P26	02/19/98 06:33:46	02/19/98 06:34:08	000:00:00:22
N10C25P45	N8C26P25	02/19/98 06:33:46	02/19/98 06:34:08	000:00:00:22
N10C25P46	N8C26P24	02/19/98 06:33:39	02/19/98 06:34:08	000:00:00:29
N10C25P41	N8C26P29	02/19/98 06:37:46	02/19/98 06:38:05	000:00:00:19
N10C25P42	N8C26P28	02/19/98 06:37:45	02/19/98 06:38:05	000:00:00:20
N10C25P43	N8C26P27	02/19/98 06:37:44	02/19/98 06:38:05	000:00:00:21
N10C25P44	N8C26P26	02/19/98 06:37:44	02/19/98 06:38:05	000:00:00:21
N10C25P45	N8C26P25	02/19/98 06:37:44	02/19/98 06:38:05	000:00:00:21
N10C25P46	N8C26P24	02/19/98 06:37:37	02/19/98 06:38:05	000:00:00:28
N10C25P41	N8C26P29	02/19/98 06:39:28	02/19/98 06:39:49	000:00:00:21
N10C25P42	N8C26P28	02/19/98 06:39:28	02/19/98 06:39:49	000:00:00:21
N10C25P43	N8C26P27	02/19/98 06:39:27	02/19/98 06:39:49	000:00:00:22
N10C25P44	N8C26P26	02/19/98 06:39:27	02/19/98 06:39:49	000:00:00:22
N10C25P45	N8C26P25	02/19/98 06:39:27	02/19/98 06:39:50	000:00:00:23
N10C25P46	N8C26P24	02/19/98 06:39:20	02/19/98 06:39:50	000:00:00:30
N10C58P25	N100C58P45	02/19/98 06:59:20	02/19/98 07:00:44	000:00:01:24
'C58P26	N100C58P44	02/19/98 06:59:20	02/19/98 07:00:44	000:00:01:24
JC58P27	N100C58P43	02/19/98 06:59:21	02/19/98 07:00:44	000:00:01:23
N10C58P28	N100C58P42	02/19/98 06:59:21	02/19/98 07:00:44	000:00:01:23
N10C58P29	N100C58P41	02/19/98 06:59:21	02/19/98 07:00:44	000:00:01:23
N10C58P30	N100C58P40	02/19/98 06:59:21	02/19/98 07:00:44	000:00:01:23
N10C58P31	N100C58P39	02/19/98 06:59:22	02/19/98 07:00:44	000:00:01:22
N10C58P32	N100C58P38	02/19/98 06:59:23	02/19/98 07:00:45	000:00:01:22
N10C58P33	N100C58P37	02/19/98 06:59:23	02/19/98 07:00:45	000:00:01:22
N10C58P34	N100C58P36	02/19/98 06:59:23	02/19/98 07:00:45	000:00:01:22
N10C58P35	N100C58P35	02/19/98 06:59:23	02/19/98 07:00:45	000:00:01:22
N10C58P36	N100C58P34	02/19/98 06:59:23	02/19/98 07:00:45	000:00:01:22
N10C58P37	N100C58P33	02/19/98 06:59:24	02/19/98 07:00:45	000:00:01:21
N10C58P38	N100C58P32	02/19/98 06:59:25	02/19/98 07:00:46	000:00:01:21
N10C58P39	N100C58P31	02/19/98 06:59:26	02/19/98 07:00:47	000:00:01:21
N10C58P40	N100C58P30	02/19/98 06:59:27	02/19/98 07:00:48	000:00:01:21
N10C58P41	N100C58P29	02/19/98 06:59:27	02/19/98 07:00:48	000:00:01:21
N10C58P42	N100C58P28	02/19/98 06:59:27	02/19/98 07:00:48	000:00:01:21
N10C58P43	N100C58P27	02/19/98 06:59:28	02/19/98 07:00:48	000:00:01:20
N10C58P44	N100C58P26	02/19/98 06:59:28	02/19/98 07:00:48	000:00:01:20
N10C58P45	N100C58P25	02/19/98 06:59:28	02/19/98 07:00:48	000:00:01:20
N10C58P46	N100C58P24	02/19/98 06:59:29	02/19/98 07:00:49	000:00:01:20
N10C58P24	N100C58P46	02/19/98 06:59:06	02/19/98 07:00:49	000:00:01:43
N10C58P26	N100C58P45	02/19/98 08:19:29	02/19/98 08:25:23	000:00:05:54
N10C58P27	N100C58P44	02/19/98 08:19:29	02/19/98 08:25:23	000:00:05:54
N10C58P28	N100C58P43	02/19/98 08:19:30	02/19/98 08:25:23	000:00:05:53
''0C58P29	N100C58P42	02/19/98 08:19:30	02/19/98 08:25:23	000:00:05:53
.C58P30	N100C58P41	02/19/98 08:19:30	02/19/98 08:25:23	000:00:05:53
N10C58P31	N100C58P40	02/19/98 08:19:30	02/19/98 08:25:23	000:00:05:53
N10C58P32	N100C58P39	02/19/98 08:19:32	02/19/98 08:25:24	000:00:05:52
N10C58P33	N100C58P38	02/19/98 08:19:32	02/19/98 08:25:24	000:00:05:52
N10C58P34	N100C58P37	02/19/98 08:19:32	02/19/98 08:25:24	000:00:05:52
N10C58P35	N100C58P36	02/19/98 08:19:33	02/19/98 08:25:25	000:00:05:52

Call Duration Report for device N10
Mon Feb 23 11:59:41 1998

From 02/16/98 00:00:00 to 02/23/98 23:59:00

Origination Port	Termination Port	Connect Time mm/dd/yy hh:mm:ss	Disconnect Time mm/dd/yy hh:mm:ss	Duration ddd:hh:mm:ss
N10C58P36	N100C58P35	02/19/98 08:19:33	02/19/98 08:25:25	000:00:05:52
N10C58P37	N100C58P34	02/19/98 08:19:33	02/19/98 08:25:25	000:00:05:52
N10C58P39	N100C58P32	02/19/98 08:19:34	02/19/98 08:25:25	000:00:05:51
N10C58P40	N100C58P31	02/19/98 08:19:36	02/19/98 08:25:26	000:00:05:50
N10C58P38	N100C58P33	02/19/98 08:19:34	02/19/98 08:25:26	000:00:05:52
N10C58P41	N100C58P30	02/19/98 08:19:35	02/19/98 08:25:26	000:00:05:51
N10C58P42	N100C58P29	02/19/98 08:19:36	02/19/98 08:25:27	000:00:05:51
N10C58P43	N100C58P28	02/19/98 08:19:36	02/19/98 08:25:27	000:00:05:51
N10C58P44	N100C58P27	02/19/98 08:19:37	02/19/98 08:25:27	000:00:05:50
N10C58P45	N100C58P26	02/19/98 08:19:38	02/19/98 08:25:28	000:00:05:50
N10C58P46	N100C58P25	02/19/98 08:19:38	02/19/98 08:25:28	000:00:05:50
N10C58P25	N100C58P46	02/19/98 08:19:16	02/19/98 08:25:28	000:00:06:12
N10C39P8	N12C10P0	01/04/98 01:34:46	02/19/98 08:40:58	046:07:06:12
N10C25P39	N8C25P9	02/19/98 09:16:19	02/19/98 09:17:53	000:00:01:34
N10C25P40	N8C25P7	02/19/98 09:16:07	02/19/98 09:17:53	000:00:01:46
N10C25P35	N8C25P13	02/19/98 09:19:07	02/19/98 09:20:37	000:00:01:30
N10C25P36	N8C25P12	02/19/98 09:19:07	02/19/98 09:20:38	000:00:01:31
1C25P37	N8C25P11	02/19/98 09:19:07	02/19/98 09:20:38	000:00:01:31
JC25P38	N8C25P10	02/19/98 09:19:06	02/19/98 09:20:38	000:00:01:32
N10C25P39	N8C25P9	02/19/98 09:19:07	02/19/98 09:20:39	000:00:01:32
N10C25P40	N8C25P7	02/19/98 09:19:02	02/19/98 09:20:39	000:00:01:37
N10C26P18	N8C25P30	02/19/98 09:22:08	02/19/98 09:22:11	000:00:00:03
N10C26P17	N8C25P31	02/19/98 09:22:09	02/19/98 09:22:12	000:00:00:03
N10C26P16	N8C25P30	02/19/98 09:22:13	02/19/98 09:22:13	000:00:00:00
N10C26P19	N8C25P29	02/19/98 09:22:08	02/19/98 09:22:13	000:00:00:05
N10C26P20	N8C25P28	02/19/98 09:22:07	02/19/98 09:22:13	000:00:00:06
N10C26P21	N8C25P27	02/19/98 09:22:07	02/19/98 09:22:13	000:00:00:06
N10C26P22	N8C25P26	02/19/98 09:22:07	02/19/98 09:22:14	000:00:00:07
N10C25P24	N8C25P25	02/19/98 09:22:07	02/19/98 09:22:14	000:00:00:07
N10C25P25	N8C25P24	02/19/98 09:22:06	02/19/98 09:22:14	000:00:00:08
N10C25P26	N8C25P22	02/19/98 09:22:06	02/19/98 09:22:15	000:00:00:09
N10C25P27	N8C25P21	02/19/98 09:22:06	02/19/98 09:22:15	000:00:00:09
N10C25P28	N8C25P20	02/19/98 09:22:05	02/19/98 09:22:15	000:00:00:10
N10C25P29	N8C25P19	02/19/98 09:22:05	02/19/98 09:22:16	000:00:00:11
N10C25P30	N8C25P18	02/19/98 09:22:05	02/19/98 09:22:16	000:00:00:11
N10C25P31	N8C25P17	02/19/98 09:22:04	02/19/98 09:22:16	000:00:00:12
N10C25P32	N8C25P16	02/19/98 09:22:05	02/19/98 09:22:17	000:00:00:12
N10C25P33	N8C25P15	02/19/98 09:22:04	02/19/98 09:22:17	000:00:00:13
N10C25P34	N8C25P14	02/19/98 09:22:04	02/19/98 09:22:17	000:00:00:13
N10C25P35	N8C25P13	02/19/98 09:22:03	02/19/98 09:22:17	000:00:00:14
N10C25P36	N8C25P12	02/19/98 09:22:03	02/19/98 09:22:18	000:00:00:15
N10C25P37	N8C25P11	02/19/98 09:22:03	02/19/98 09:22:18	000:00:00:15
'nC25P38	N8C25P10	02/19/98 09:22:02	02/19/98 09:22:18	000:00:00:16
JC25P39	N8C25P9	02/19/98 09:22:02	02/19/98 09:22:19	000:00:00:17
N10C25P40	N8C25P7	02/19/98 09:21:57	02/19/98 09:22:19	000:00:00:22
N10C25P29	N8C25P19	02/19/98 09:22:52	02/19/98 09:23:24	000:00:00:32
N10C25P30	N8C25P18	02/19/98 09:22:52	02/19/98 09:23:24	000:00:00:32
N10C25P31	N8C25P17	02/19/98 09:22:52	02/19/98 09:23:25	000:00:00:33
N10C25P32	N8C25P16	02/19/98 09:22:51	02/19/98 09:23:25	000:00:00:34

Call Duration Report for device N10
Mon Feb 23 11:59:41 1998

From 02/16/98 00:00:00 to 02/23/98 23:59:00

Origination Port	Termination Port	Connect Time mm/dd/yy hh:mm:ss	Disconnect Time mm/dd/yy hh:mm:ss	Duration ddd:hh:mm:ss
N10C25P33	N8C25P15	02/19/98 09:22:51	02/19/98 09:23:25	000:00:00:34
N10C25P34	N8C25P14	02/19/98 09:22:51	02/19/98 09:23:26	000:00:00:35
N10C25P35	N8C25P13	02/19/98 09:22:51	02/19/98 09:23:26	000:00:00:35
N10C25P36	N8C25P12	02/19/98 09:22:50	02/19/98 09:23:26	000:00:00:36
N10C25P37	N8C25P11	02/19/98 09:22:50	02/19/98 09:23:27	000:00:00:37
N10C25P38	N8C25P10	02/19/98 09:22:50	02/19/98 09:23:27	000:00:00:37
N10C25P39	N8C25P9	02/19/98 09:22:49	02/19/98 09:23:27	000:00:00:38
N10C25P40	N8C25P7	02/19/98 09:22:44	02/19/98 09:23:27	000:00:00:43
N10C25P35	N8C25P13	02/19/98 09:27:59	02/19/98 09:34:47	000:00:06:48
N10C25P36	N8C25P12	02/19/98 09:27:58	02/19/98 09:34:47	000:00:06:49
N10C25P37	N8C25P11	02/19/98 09:27:58	02/19/98 09:34:47	000:00:06:49
N10C25P38	N8C25P10	02/19/98 09:27:58	02/19/98 09:34:48	000:00:06:50
N10C25P39	N8C25P9	02/19/98 09:27:57	02/19/98 09:34:48	000:00:06:51
N10C25P40	N8C25P7	02/19/98 09:27:53	02/19/98 09:34:48	000:00:06:55
N10C27P7	N10C43P0	09/16/97 12:55:46	02/19/98 09:49:05	155:21:53:19
N10C43P1	N11C43P1	01/27/98 09:23:43	02/19/98 09:49:05	023:00:25:22
N10C43P2	N70C43P1	12/17/97 15:58:56	02/19/98 09:49:05	063:17:50:09
C43P3	N20C27P0	12/17/97 15:58:56	02/19/98 09:49:05	063:17:50:09
JC43P4	N80C22P0	02/02/98 14:47:45	02/19/98 09:49:05	016:19:01:20
N10C43P7	N10C59P0	09/16/97 12:55:16	02/19/98 09:49:05	155:21:53:49
N10C58P47	N10C43P5	02/18/98 16:11:44	02/19/98 09:49:05	000:17:37:21
N10C58P25	N100C58P27	02/19/98 12:34:44	02/19/98 12:35:33	000:00:00:49
N10C58P26	N100C58P26	02/19/98 12:34:44	02/19/98 12:35:33	000:00:00:49
N10C58P27	N100C58P25	02/19/98 12:34:44	02/19/98 12:35:33	000:00:00:49
N10C58P28	N100C58P24	02/19/98 12:34:44	02/19/98 12:35:33	000:00:00:49
N10C58P24	N100C58P28	02/19/98 12:34:34	02/19/98 12:35:33	000:00:00:59
N10C58P25	N100C58P45	02/19/98 12:38:45	02/19/98 12:56:04	000:00:17:19
N10C58P26	N100C58P44	02/19/98 12:38:45	02/19/98 12:56:04	000:00:17:19
N10C58P27	N100C58P43	02/19/98 12:38:45	02/19/98 12:56:04	000:00:17:19
N10C58P28	N100C58P42	02/19/98 12:38:45	02/19/98 12:56:04	000:00:17:19
N10C58P29	N100C58P41	02/19/98 12:38:45	02/19/98 12:56:04	000:00:17:19
N10C58P30	N100C58P40	02/19/98 12:38:45	02/19/98 12:56:04	000:00:17:19
N10C58P31	N100C58P39	02/19/98 12:38:47	02/19/98 12:56:05	000:00:17:18
N10C58P32	N100C58P38	02/19/98 12:38:47	02/19/98 12:56:05	000:00:17:18
N10C58P33	N100C58P37	02/19/98 12:38:48	02/19/98 12:56:05	000:00:17:17
N10C58P34	N100C58P36	02/19/98 12:38:49	02/19/98 12:56:06	000:00:17:17
N10C58P35	N100C58P35	02/19/98 12:38:49	02/19/98 12:56:06	000:00:17:17
N10C58P36	N100C58P34	02/19/98 12:38:49	02/19/98 12:56:06	000:00:17:17
N10C58P37	N100C58P33	02/19/98 12:38:50	02/19/98 12:56:06	000:00:17:16
N10C58P38	N100C58P32	02/19/98 12:38:50	02/19/98 12:56:06	000:00:17:16
N10C58P39	N100C58P31	02/19/98 12:38:51	02/19/98 12:56:07	000:00:17:16
N10C58P40	N100C58P30	02/19/98 12:38:51	02/19/98 12:56:07	000:00:17:16
C58P41	N100C58P29	02/19/98 12:38:52	02/19/98 12:56:07	000:00:17:15
JC58P42	N100C58P28	02/19/98 12:38:52	02/19/98 12:56:08	000:00:17:16
N10C58P43	N100C58P27	02/19/98 12:38:52	02/19/98 12:56:08	000:00:17:16
N10C58P44	N100C58P26	02/19/98 12:38:53	02/19/98 12:56:08	000:00:17:15
N10C58P45	N100C58P25	02/19/98 12:38:53	02/19/98 12:56:08	000:00:17:15
N10C58P46	N100C58P24	02/19/98 12:38:54	02/19/98 12:56:09	000:00:17:15
N10C58P24	N100C58P46	02/19/98 12:38:31	02/19/98 12:56:09	000:00:17:38

Call Duration Report for device N10
Mon Feb 23 11:59:41 1998

From 02/16/98 00:00:00 to 02/23/98 23:59:00

Origination Port	Termination Port	Connect Time mm/dd/yy hh:mm:ss	Disconnect Time mm/dd/yy hh:mm:ss	Duration ddd:hh:mm:ss
N10C58P25	N100C58P45	02/19/98 14:06:53	02/19/98 14:08:01	000:00:01:08
N10C58P26	N100C58P44	02/19/98 14:06:53	02/19/98 14:08:02	000:00:01:09
N10C58P27	N100C58P43	02/19/98 14:06:54	02/19/98 14:08:02	000:00:01:08
N10C58P28	N100C58P42	02/19/98 14:06:54	02/19/98 14:08:02	000:00:01:08
N10C58P29	N100C58P41	02/19/98 14:06:54	02/19/98 14:08:02	000:00:01:08
N10C58P30	N100C58P40	02/19/98 14:06:54	02/19/98 14:08:02	000:00:01:08
N10C58P31	N100C58P39	02/19/98 14:06:55	02/19/98 14:08:02	000:00:01:07
N10C58P32	N100C58P38	02/19/98 14:06:56	02/19/98 14:08:03	000:00:01:07
N10C58P33	N100C58P37	02/19/98 14:06:56	02/19/98 14:08:05	000:00:01:09
N10C58P34	N100C58P36	02/19/98 14:06:56	02/19/98 14:08:05	000:00:01:09
N10C58P36	N100C58P34	02/19/98 14:06:57	02/19/98 14:08:06	000:00:01:09
N10C58P37	N100C58P33	02/19/98 14:06:58	02/19/98 14:08:06	000:00:01:08
N10C58P35	N100C58P35	02/19/98 14:06:56	02/19/98 14:08:06	000:00:01:10
N10C58P38	N100C58P32	02/19/98 14:06:59	02/19/98 14:08:07	000:00:01:08
N10C58P39	N100C58P31	02/19/98 14:06:59	02/19/98 14:08:07	000:00:01:08
N10C58P40	N100C58P30	02/19/98 14:06:59	02/19/98 14:08:07	000:00:01:08
N10C58P41	N100C58P29	02/19/98 14:06:59	02/19/98 14:08:07	000:00:01:08
:58P42	N100C58P28	02/19/98 14:06:59	02/19/98 14:08:07	000:00:01:08
JC58P43	N100C58P27	02/19/98 14:07:01	02/19/98 14:08:08	000:00:01:07
N10C58P44	N100C58P26	02/19/98 14:07:02	02/19/98 14:08:08	000:00:01:06
N10C58P45	N100C58P25	02/19/98 14:07:02	02/19/98 14:08:08	000:00:01:06
N10C58P46	N100C58P24	02/19/98 14:07:02	02/19/98 14:08:09	000:00:01:07
N10C58P24	N100C58P46	02/19/98 14:06:40	02/19/98 14:08:09	000:00:01:29
N10C58P26	N100C58P45	02/19/98 14:25:54	02/19/98 14:28:30	000:00:02:36
N10C58P27	N100C58P44	02/19/98 14:25:54	02/19/98 14:28:30	000:00:02:36
N10C58P28	N100C58P43	02/19/98 14:25:54	02/19/98 14:28:30	000:00:02:36
N10C58P29	N100C58P42	02/19/98 14:25:54	02/19/98 14:28:30	000:00:02:36
N10C58P30	N100C58P41	02/19/98 14:25:54	02/19/98 14:28:30	000:00:02:36
N10C58P31	N100C58P40	02/19/98 14:25:54	02/19/98 14:28:30	000:00:02:36
N10C58P32	N100C58P39	02/19/98 14:25:56	02/19/98 14:28:31	000:00:02:35
N10C58P33	N100C58P38	02/19/98 14:25:57	02/19/98 14:28:31	000:00:02:34
N10C58P34	N100C58P37	02/19/98 14:25:57	02/19/98 14:28:31	000:00:02:34
N10C58P25	N100C58P46	02/19/98 14:25:40	02/19/98 14:28:32	000:00:02:52
N10C58P35	N100C58P36	02/19/98 14:25:57	02/19/98 14:28:32	000:00:02:35
N10C58P36	N100C58P35	02/19/98 14:25:58	02/19/98 14:28:32	000:00:02:34
N10C58P37	N100C58P34	02/19/98 14:25:58	02/19/98 14:28:32	000:00:02:34
N10C58P38	N100C58P33	02/19/98 14:25:59	02/19/98 14:28:32	000:00:02:33
N10C58P39	N100C58P32	02/19/98 14:26:00	02/19/98 14:28:32	000:00:02:32
N10C58P40	N100C58P31	02/19/98 14:26:00	02/19/98 14:28:32	000:00:02:32
N10C58P41	N100C58P30	02/19/98 14:26:00	02/19/98 14:28:32	000:00:02:32
N10C58P42	N100C58P29	02/19/98 14:26:00	02/19/98 14:28:32	000:00:02:32
N10C58P43	N100C58P28	02/19/98 14:26:01	02/19/98 14:28:32	000:00:02:31
:58P44	N100C58P27	02/19/98 14:26:02	02/19/98 14:28:32	000:00:02:30
.C58P45	N100C58P26	02/19/98 14:26:02	02/19/98 14:28:32	000:00:02:30
N10C58P46	N100C58P25	02/19/98 14:26:03	02/19/98 14:28:32	000:00:02:29
N10C25P41	N8C26P8	02/19/98 06:51:49	02/19/98 16:04:19	000:09:12:30
N10C25P42	N8C26P7	02/19/98 06:51:49	02/19/98 16:04:19	000:09:12:30
N10C25P43	N8C26P6	02/19/98 06:51:49	02/19/98 16:04:20	000:09:12:31
N10C25P44	N8C26P4	02/19/98 06:51:49	02/19/98 16:04:20	000:09:12:31

Call Duration Report for device N10
Mon Feb 23 11:59:41 1998

From 02/16/98 00:00:00 to 02/23/98 23:59:00

Origination Port	Termination Port	Connect Time mm/dd/yy hh:mm:ss	Disconnect Time mm/dd/yy hh:mm:ss	Duration ddd:hh:mm:ss
N10C25P45	N8C26P2	02/19/98 06:51:48	02/19/98 16:04:20	000:09:12:32
N10C25P46	N8C26P30	02/19/98 06:51:41	02/19/98 16:04:20	000:09:12:39
N10C58P26	N100C58P45	02/19/98 17:17:17	02/19/98 17:19:33	000:00:02:16
N10C58P27	N100C58P44	02/19/98 17:17:17	02/19/98 17:19:33	000:00:02:16
N10C58P28	N100C58P43	02/19/98 17:17:17	02/19/98 17:19:33	000:00:02:16
N10C58P29	N100C58P42	02/19/98 17:17:17	02/19/98 17:19:33	000:00:02:16
N10C58P30	N100C58P41	02/19/98 17:17:17	02/19/98 17:19:33	000:00:02:16
N10C58P31	N100C58P40	02/19/98 17:17:17	02/19/98 17:19:33	000:00:02:16
N10C58P32	N100C58P39	02/19/98 17:17:19	02/19/98 17:19:33	000:00:02:14
N10C58P33	N100C58P38	02/19/98 17:17:19	02/19/98 17:19:33	000:00:02:14
N10C58P34	N100C58P37	02/19/98 17:17:19	02/19/98 17:19:33	000:00:02:14
N10C58P35	N100C58P36	02/19/98 17:17:20	02/19/98 17:19:34	000:00:02:14
N10C58P36	N100C58P35	02/19/98 17:17:20	02/19/98 17:19:34	000:00:02:14
N10C58P25	N100C58P46	02/19/98 17:17:02	02/19/98 17:19:34	000:00:02:32
N10C58P37	N100C58P34	02/19/98 17:17:20	02/19/98 17:19:34	000:00:02:14
N10C58P38	N100C58P33	02/19/98 17:17:22	02/19/98 17:19:34	000:00:02:12
N10C58P39	N100C58P32	02/19/98 17:17:22	02/19/98 17:19:34	000:00:02:12
58P40	N100C58P31	02/19/98 17:17:22	02/19/98 17:19:34	000:00:02:12
JC58P41	N100C58P30	02/19/98 17:17:23	02/19/98 17:19:34	000:00:02:11
N10C58P42	N100C58P29	02/19/98 17:17:23	02/19/98 17:19:34	000:00:02:11
N10C58P43	N100C58P28	02/19/98 17:17:23	02/19/98 17:19:34	000:00:02:11
N10C58P44	N100C58P27	02/19/98 17:17:24	02/19/98 17:19:34	000:00:02:10
N10C58P45	N100C58P26	02/19/98 17:17:25	02/19/98 17:19:34	000:00:02:09
N10C58P46	N100C58P25	02/19/98 17:17:25	02/19/98 17:19:34	000:00:02:09
N10C58P26	N100C58P45	02/20/98 07:41:34	02/20/98 07:42:33	000:00:00:59
N10C58P27	N100C58P44	02/20/98 07:41:34	02/20/98 07:42:33	000:00:00:59
N10C58P28	N100C58P43	02/20/98 07:41:34	02/20/98 07:42:33	000:00:00:59
N10C58P29	N100C58P42	02/20/98 07:41:34	02/20/98 07:42:33	000:00:00:59
N10C58P30	N100C58P41	02/20/98 07:41:34	02/20/98 07:42:33	000:00:00:59
N10C58P31	N100C58P40	02/20/98 07:41:35	02/20/98 07:42:35	000:00:01:00
N10C58P32	N100C58P39	02/20/98 07:41:37	02/20/98 07:42:35	000:00:00:58
N10C58P34	N100C58P37	02/20/98 07:41:37	02/20/98 07:42:35	000:00:00:58
N10C58P33	N100C58P38	02/20/98 07:41:37	02/20/98 07:42:35	000:00:00:58
N10C58P35	N100C58P36	02/20/98 07:41:38	02/20/98 07:42:35	000:00:00:57
N10C58P36	N100C58P35	02/20/98 07:41:38	02/20/98 07:42:35	000:00:00:57
N10C58P37	N100C58P34	02/20/98 07:41:38	02/20/98 07:42:36	000:00:00:58
N10C58P38	N100C58P33	02/20/98 07:41:39	02/20/98 07:42:36	000:00:00:57
N10C58P39	N100C58P32	02/20/98 07:41:40	02/20/98 07:42:37	000:00:00:57
N10C58P40	N100C58P31	02/20/98 07:41:40	02/20/98 07:42:37	000:00:00:57
N10C58P41	N100C58P30	02/20/98 07:41:41	02/20/98 07:42:37	000:00:00:56
N10C58P42	N100C58P29	02/20/98 07:41:41	02/20/98 07:42:37	000:00:00:56
N10C58P43	N100C58P28	02/20/98 07:41:41	02/20/98 07:42:37	000:00:00:56
58P44	N100C58P27	02/20/98 07:41:42	02/20/98 07:42:37	000:00:00:55
58P45	N100C58P26	02/20/98 07:41:42	02/20/98 07:42:37	000:00:00:55
N10C58P46	N100C58P25	02/20/98 07:41:43	02/20/98 07:42:38	000:00:00:55
N10C58P25	N100C58P46	02/20/98 07:41:21	02/20/98 07:42:38	000:00:01:17
N10C58P26	N100C58P45	02/20/98 07:43:55	02/20/98 07:46:30	000:00:02:35
N10C58P27	N100C58P44	02/20/98 07:43:56	02/20/98 07:46:31	000:00:02:35
N10C58P28	N100C58P43	02/20/98 07:43:57	02/20/98 07:46:31	000:00:02:34

```
                    Call Duration Report for device N10
                        Mon Feb 23 11:59:41 1998

                 From 02/16/98 00:00:00 to 02/23/98 23:59:00


Origination   Termination   Connect Time        Disconnect Time     Duration
Port          Port          mm/dd/yy hh:mm:ss    mm/dd/yy hh:mm:ss   ddd:hh:mm:ss


N10C58P29     N100C58P42    02/20/98 07:43:57    02/20/98 07:46:31   000:00:02:34
N10C58P30     N100C58P41    02/20/98 07:43:57    02/20/98 07:46:31   000:00:02:34
N10C58P31     N100C58P40    02/20/98 07:43:57    02/20/98 07:46:31   000:00:02:34
N10C58P32     N100C58P39    02/20/98 07:43:59    02/20/98 07:46:31   000:00:02:32
N10C58P33     N100C58P38    02/20/98 07:43:59    02/20/98 07:46:31   000:00:02:32
N10C58P34     N100C58P37    02/20/98 07:43:59    02/20/98 07:46:31   000:00:02:32
N10C58P35     N100C58P36    02/20/98 07:43:59    02/20/98 07:46:31   000:00:02:32
N10C58P36     N100C58P35    02/20/98 07:44:00    02/20/98 07:46:32   000:00:02:32
N10C58P37     N100C58P34    02/20/98 07:44:00    02/20/98 07:46:32   000:00:02:32
N10C58P38     N100C58P33    02/20/98 07:44:02    02/20/98 07:46:33   000:00:02:31
N10C58P39     N100C58P32    02/20/98 07:44:02    02/20/98 07:46:33   000:00:02:31
N10C58P40     N100C58P31    02/20/98 07:44:02    02/20/98 07:46:33   000:00:02:31
N10C58P41     N100C58P30    02/20/98 07:44:02    02/20/98 07:46:33   000:00:02:31
N10C58P42     N100C58P29    02/20/98 07:44:03    02/20/98 07:46:34   000:00:02:31
N10C58P43     N100C58P28    02/20/98 07:44:03    02/20/98 07:46:34   000:00:02:31
N10C58P44     N100C58P27    02/20/98 07:44:04    02/20/98 07:46:34   000:00:02:30
N10C58P45     N100C58P26    02/20/98 07:44:05    02/20/98 07:46:34   000:00:02:29
 C58P46       N100C58P25    02/20/98 07:44:05    02/20/98 07:46:34   000:00:02:29
 JC58P25      N100C58P46    02/20/98 07:43:42    02/20/98 07:46:35   000:00:02:53
N10C58P26     N100C58P45    02/20/98 08:50:14    02/20/98 08:51:58   000:00:01:44
N10C58P27     N100C58P44    02/20/98 08:50:14    02/20/98 08:51:58   000:00:01:44
N10C58P28     N100C58P43    02/20/98 08:50:14    02/20/98 08:51:58   000:00:01:44
N10C58P29     N100C58P42    02/20/98 08:50:14    02/20/98 08:51:58   000:00:01:44
N10C58P30     N100C58P41    02/20/98 08:50:14    02/20/98 08:51:58   000:00:01:44
N10C58P31     N100C58P40    02/20/98 08:50:14    02/20/98 08:51:58   000:00:01:44
N10C58P32     N100C58P39    02/20/98 08:50:16    02/20/98 08:51:59   000:00:01:43
N10C58P33     N100C58P38    02/20/98 08:50:17    02/20/98 08:51:59   000:00:01:42
N10C58P34     N100C58P37    02/20/98 08:50:16    02/20/98 08:51:59   000:00:01:43
N10C58P35     N100C58P36    02/20/98 08:50:17    02/20/98 08:51:59   000:00:01:42
N10C58P36     N100C58P35    02/20/98 08:50:17    02/20/98 08:51:59   000:00:01:42
N10C58P37     N100C58P34    02/20/98 08:50:17    02/20/98 08:51:59   000:00:01:42
N10C58P38     N100C58P33    02/20/98 08:50:18    02/20/98 08:51:59   000:00:01:41
N10C58P39     N100C58P32    02/20/98 08:50:19    02/20/98 08:52:00   000:00:01:41
N10C58P40     N100C58P31    02/20/98 08:50:19    02/20/98 08:52:00   000:00:01:41
N10C58P41     N100C58P30    02/20/98 08:50:19    02/20/98 08:52:00   000:00:01:41
N10C58P42     N100C58P29    02/20/98 08:50:20    02/20/98 08:52:00   000:00:01:40
N10C58P43     N100C58P28    02/20/98 08:50:20    02/20/98 08:52:00   000:00:01:40
N10C58P44     N100C58P27    02/20/98 08:50:21    02/20/98 08:52:01   000:00:01:40
N10C58P45     N100C58P26    02/20/98 08:50:22    02/20/98 08:52:01   000:00:01:39
N10C58P46     N100C58P25    02/20/98 08:50:22    02/20/98 08:52:01   000:00:01:39
N10C58P25     N100C58P46    02/20/98 08:49:59    02/20/98 08:52:01   000:00:02:02
N10C58P26     N100C58P45    02/20/98 09:04:56    02/20/98 09:07:09   000:00:02:13
 C58P27       N100C58P44    02/20/98 09:04:56    02/20/98 09:07:09   000:00:02:13
 JC58P28      N100C58P43    02/20/98 09:04:56    02/20/98 09:07:09   000:00:02:13
N10C58P29     N100C58P42    02/20/98 09:04:56    02/20/98 09:07:09   000:00:02:13
N10C58P30     N100C58P41    02/20/98 09:04:56    02/20/98 09:07:09   000:00:02:13
N10C58P31     N100C58P40    02/20/98 09:04:56    02/20/98 09:07:09   000:00:02:13
N10C58P32     N100C58P39    02/20/98 09:04:58    02/20/98 09:07:10   000:00:02:12
N10C58P33     N100C58P38    02/20/98 09:04:58    02/20/98 09:07:10   000:00:02:12
```

Call Duration Report for device N10
Mon Feb 23 11:59:41 1998

From 02/16/98 00:00:00 to 02/23/98 23:59:00

Origination Port	Termination Port	Connect Time mm/dd/yy hh:mm:ss	Disconnect Time mm/dd/yy hh:mm:ss	Duration ddd:hh:mm:ss
N10C58P34	N100C58P37	02/20/98 09:04:59	02/20/98 09:07:10	000:00:02:11
N10C58P25	N100C58P46	02/20/98 09:04:42	02/20/98 09:07:11	000:00:02:29
N10C58P35	N100C58P36	02/20/98 09:04:59	02/20/98 09:07:11	000:00:02:12
N10C58P36	N100C58P35	02/20/98 09:04:59	02/20/98 09:07:11	000:00:02:12
N10C58P37	N100C58P34	02/20/98 09:05:00	02/20/98 09:07:11	000:00:02:11
N10C58P38	N100C58P33	02/20/98 09:05:01	02/20/98 09:07:11	000:00:02:10
N10C58P39	N100C58P32	02/20/98 09:05:01	02/20/98 09:07:11	000:00:02:10
N10C58P40	N100C58P31	02/20/98 09:05:01	02/20/98 09:07:11	000:00:02:10
N10C58P41	N100C58P30	02/20/98 09:05:02	02/20/98 09:07:11	000:00:02:09
N10C58P42	N100C58P29	02/20/98 09:05:02	02/20/98 09:07:11	000:00:02:09
N10C58P43	N100C58P28	02/20/98 09:05:03	02/20/98 09:07:11	000:00:02:08
N10C58P44	N100C58P27	02/20/98 09:05:03	02/20/98 09:07:11	000:00:02:08
N10C58P45	N100C58P26	02/20/98 09:05:04	02/20/98 09:07:11	000:00:02:07
N10C58P46	N100C58P25	02/20/98 09:05:04	02/20/98 09:07:11	000:00:02:07
N10C58P26	N100C58P45	02/20/98 09:25:01	02/20/98 09:34:26	000:00:09:25
N10C58P27	N100C58P44	02/20/98 09:25:02	02/20/98 09:34:27	000:00:09:25
N10C58P28	N100C58P43	02/20/98 09:25:02	02/20/98 09:34:27	000:00:09:25
)C58P29	N100C58P42	02/20/98 09:25:02	02/20/98 09:34:27	000:00:09:25
,0C58P30	N100C58P41	02/20/98 09:25:02	02/20/98 09:34:27	000:00:09:25
N10C58P31	N100C58P40	02/20/98 09:25:02	02/20/98 09:34:27	000:00:09:25
N10C58P32	N100C58P39	02/20/98 09:25:04	02/20/98 09:34:27	000:00:09:23
N10C58P33	N100C58P38	02/20/98 09:25:04	02/20/98 09:34:27	000:00:09:23
N10C58P34	N100C58P37	02/20/98 09:25:04	02/20/98 09:34:27	000:00:09:23
N10C58P35	N100C58P36	02/20/98 09:25:05	02/20/98 09:34:27	000:00:09:22
N10C58P36	N100C58P35	02/20/98 09:25:06	02/20/98 09:34:28	000:00:09:22
N10C58P37	N100C58P34	02/20/98 09:25:05	02/20/98 09:34:28	000:00:09:23
N10C58P38	N100C58P33	02/20/98 09:25:06	02/20/98 09:34:28	000:00:09:22
N10C58P39	N100C58P32	02/20/98 09:25:08	02/20/98 09:34:29	000:00:09:21
N10C58P40	N100C58P31	02/20/98 09:25:07	02/20/98 09:34:29	000:00:09:22
N10C58P41	N100C58P30	02/20/98 09:25:08	02/20/98 09:34:29	000:00:09:21
N10C58P42	N100C58P29	02/20/98 09:25:09	02/20/98 09:34:30	000:00:09:21
N10C58P43	N100C58P28	02/20/98 09:25:09	02/20/98 09:34:30	000:00:09:21
N10C58P44	N100C58P27	02/20/98 09:25:10	02/20/98 09:34:31	000:00:09:21
N10C58P45	N100C58P26	02/20/98 09:25:10	02/20/98 09:34:31	000:00:09:21
N10C58P46	N100C58P25	02/20/98 09:25:10	02/20/98 09:34:31	000:00:09:21
N10C58P25	N100C58P46	02/20/98 09:24:48	02/20/98 09:34:31	000:00:09:43
N10C58P26	N100C58P45	02/20/98 09:43:33	02/20/98 09:45:21	000:00:01:48
N10C58P27	N100C58P44	02/20/98 09:43:33	02/20/98 09:45:21	000:00:01:48
N10C58P28	N100C58P43	02/20/98 09:43:33	02/20/98 09:45:21	000:00:01:48
N10C58P29	N100C58P42	02/20/98 09:43:33	02/20/98 09:45:21	000:00:01:48
N10C58P30	N100C58P41	02/20/98 09:43:33	02/20/98 09:45:21	000:00:01:48
N10C58P31	N100C58P40	02/20/98 09:43:33	02/20/98 09:45:22	000:00:01:49
?C58P32	N100C58P39	02/20/98 09:43:35	02/20/98 09:45:22	000:00:01:47
?C58P33	N100C58P38	02/20/98 09:43:36	02/20/98 09:45:22	000:00:01:46
N10C58P34	N100C58P37	02/20/98 09:43:37	02/20/98 09:45:24	000:00:01:47
N10C58P35	N100C58P36	02/20/98 09:43:37	02/20/98 09:45:24	000:00:01:47
N10C58P36	N100C58P35	02/20/98 09:43:37	02/20/98 09:45:24	000:00:01:47
N10C58P37	N100C58P34	02/20/98 09:43:37	02/20/98 09:45:24	000:00:01:47
N10C58P38	N100C58P33	02/20/98 09:43:38	02/20/98 09:45:24	000:00:01:46

Call Duration Report for device N10
Mon Feb 23 11:59:41 1998

From 02/16/98 00:00:00 to 02/23/98 23:59:00

Origination Port	Termination Port	Connect Time mm/dd/yy hh:mm:ss	Disconnect Time mm/dd/yy hh:mm:ss	Duration ddd:hh:mm:ss
N10C58P39	N100C58P32	02/20/98 09:43:39	02/20/98 09:45:24	000:00:01:45
N10C58P40	N100C58P31	02/20/98 09:43:39	02/20/98 09:45:25	000:00:01:46
N10C58P41	N100C58P30	02/20/98 09:43:40	02/20/98 09:45:25	000:00:01:45
N10C58P42	N100C58P29	02/20/98 09:43:40	02/20/98 09:45:25	000:00:01:45
N10C58P43	N100C58P28	02/20/98 09:43:40	02/20/98 09:45:25	000:00:01:45
N10C58P44	N100C58P27	02/20/98 09:43:41	02/20/98 09:45:25	000:00:01:44
N10C58P45	N100C58P26	02/20/98 09:43:42	02/20/98 09:45:26	000:00:01:44
N10C58P46	N100C58P25	02/20/98 09:43:42	02/20/98 09:45:26	000:00:01:44
N10C58P25	N100C58P46	02/20/98 09:43:19	02/20/98 09:45:26	000:00:02:07
N10C58P26	N100C58P45	02/20/98 09:47:26	02/20/98 09:50:36	000:00:03:10
N10C58P27	N100C58P44	02/20/98 09:47:25	02/20/98 09:50:36	000:00:03:11
N10C58P28	N100C58P43	02/20/98 09:47:25	02/20/98 09:50:36	000:00:03:11
N10C58P29	N100C58P42	02/20/98 09:47:26	02/20/98 09:50:36	000:00:03:10
N10C58P30	N100C58P41	02/20/98 09:47:27	02/20/98 09:50:37	000:00:03:10
N10C58P31	N100C58P40	02/20/98 09:47:27	02/20/98 09:50:37	000:00:03:10
N10C58P32	N100C58P39	02/20/98 09:47:28	02/20/98 09:50:38	000:00:03:10
N10C58P33	N100C58P38	02/20/98 09:47:28	02/20/98 09:50:38	000:00:03:10
C58P34	N100C58P37	02/20/98 09:47:28	02/20/98 09:50:38	000:00:03:10
C58P35	N100C58P36	02/20/98 09:47:29	02/20/98 09:50:38	000:00:03:09
N10C58P36	N100C58P35	02/20/98 09:47:30	02/20/98 09:50:39	000:00:03:09
N10C58P37	N100C58P34	02/20/98 09:47:29	02/20/98 09:50:39	000:00:03:10
N10C58P38	N100C58P33	02/20/98 09:47:31	02/20/98 09:50:40	000:00:03:09
N10C58P39	N100C58P32	02/20/98 09:47:31	02/20/98 09:50:40	000:00:03:09
N10C58P40	N100C58P31	02/20/98 09:47:31	02/20/98 09:50:40	000:00:03:09
N10C58P41	N100C58P30	02/20/98 09:47:32	02/20/98 09:50:41	000:00:03:09
N10C58P42	N100C58P29	02/20/98 09:47:33	02/20/98 09:50:41	000:00:03:08
N10C58P43	N100C58P28	02/20/98 09:47:33	02/20/98 09:50:41	000:00:03:08
N10C58P44	N100C58P27	02/20/98 09:47:34	02/20/98 09:50:41	000:00:03:07
N10C58P45	N100C58P26	02/20/98 09:47:34	02/20/98 09:50:42	000:00:03:08
N10C58P46	N100C58P25	02/20/98 09:47:34	02/20/98 09:50:42	000:00:03:08
N10C58P25	N100C58P46	02/20/98 09:47:12	02/20/98 09:50:42	000:00:03:30
N10C58P26	N100C58P45	02/20/98 11:57:25	02/20/98 11:58:22	000:00:00:57
N10C58P27	N100C58P44	02/20/98 11:57:25	02/20/98 11:58:22	000:00:00:57
N10C58P28	N100C58P43	02/20/98 11:57:26	02/20/98 11:58:22	000:00:00:56
N10C58P29	N100C58P42	02/20/98 11:57:26	02/20/98 11:58:22	000:00:00:56
N10C58P30	N100C58P41	02/20/98 11:57:26	02/20/98 11:58:22	000:00:00:56
N10C58P31	N100C58P40	02/20/98 11:57:26	02/20/98 11:58:23	000:00:00:57
N10C58P32	N100C58P39	02/20/98 11:57:28	02/20/98 11:58:24	000:00:00:56
N10C58P33	N100C58P38	02/20/98 11:57:28	02/20/98 11:58:24	000:00:00:56
N10C58P34	N100C58P37	02/20/98 11:57:28	02/20/98 11:58:24	000:00:00:56
N10C58P35	N100C58P36	02/20/98 11:57:28	02/20/98 11:58:24	000:00:00:56
N10C58P36	N100C58P35	02/20/98 11:57:30	02/20/98 11:58:25	000:00:00:55
0C58P37	N100C58P34	02/20/98 11:57:29	02/20/98 11:58:25	000:00:00:56
C58P38	N100C58P33	02/20/98 11:57:30	02/20/98 11:58:25	000:00:00:55
0C58P39	N100C58P32	02/20/98 11:57:31	02/20/98 11:58:26	000:00:00:55
N10C58P40	N100C58P31	02/20/98 11:57:31	02/20/98 11:58:26	000:00:00:55
N10C58P41	N100C58P30	02/20/98 11:57:32	02/20/98 11:58:26	000:00:00:54
N10C58P42	N100C58P29	02/20/98 11:57:32	02/20/98 11:58:26	000:00:00:54
N10C58P43	N100C58P28	02/20/98 11:57:32	02/20/98 11:58:26	000:00:00:54

Call Duration Report for device N10
Mon Feb 23 11:59:41 1998

From 02/16/98 00:00:00 to 02/23/98 23:59:00

Origination Port	Termination Port	Connect Time mm/dd/yy hh:mm:ss	Disconnect Time mm/dd/yy hh:mm:ss	Duration ddd:hh:mm:ss
N10C58P44	N100C58P27	02/20/98 11:57:33	02/20/98 11:58:26	000:00:00:53
N10C58P45	N100C58P26	02/20/98 11:57:34	02/20/98 11:58:27	000:00:00:53
N10C58P46	N100C58P25	02/20/98 11:57:34	02/20/98 11:58:27	000:00:00:53
N10C58P25	N100C58P46	02/20/98 11:57:12	02/20/98 11:58:28	000:00:01:16
N10C58P25	N100C58P45	02/20/98 16:14:07	02/20/98 16:15:06	000:00:00:59
N10C58P26	N100C58P44	02/20/98 16:14:08	02/20/98 16:15:07	000:00:00:59
N10C58P27	N100C58P43	02/20/98 16:14:09	02/20/98 16:15:07	000:00:00:58
N10C58P28	N100C58P42	02/20/98 16:14:09	02/20/98 16:15:07	000:00:00:58
N10C58P29	N100C58P41	02/20/98 16:14:09	02/20/98 16:15:07	000:00:00:58
N10C58P30	N100C58P40	02/20/98 16:14:09	02/20/98 16:15:07	000:00:00:58
N10C58P31	N100C58P39	02/20/98 16:14:10	02/20/98 16:15:08	000:00:00:58
N10C58P37	N100C58P33	02/20/98 16:14:13	02/20/98 16:15:09	000:00:00:56
N10C58P32	N100C58P38	02/20/98 16:14:10	02/20/98 16:15:09	000:00:00:59
N10C58P38	N100C58P32	02/20/98 16:14:14	02/20/98 16:15:10	000:00:00:56
N10C58P39	N100C58P31	02/20/98 16:14:14	02/20/98 16:15:10	000:00:00:56
N10C58P33	N100C58P37	02/20/98 16:14:11	02/20/98 16:15:11	000:00:01:00
N10C58P34	N100C58P36	02/20/98 16:14:12	02/20/98 16:15:11	000:00:00:59
˙58P40	N100C58P30	02/20/98 16:14:14	02/20/98 16:15:11	000:00:00:57
ˌC58P35	N100C58P35	02/20/98 16:14:11	02/20/98 16:15:11	000:00:01:00
N10C58P36	N100C58P34	02/20/98 16:14:11	02/20/98 16:15:11	000:00:01:00
N10C58P41	N100C58P29	02/20/98 16:14:15	02/20/98 16:15:12	000:00:00:57
N10C58P42	N100C58P28	02/20/98 16:14:15	02/20/98 16:15:12	000:00:00:57
N10C58P43	N100C58P27	02/20/98 16:14:15	02/20/98 16:15:12	000:00:00:57
N10C58P44	N100C58P26	02/20/98 16:14:16	02/20/98 16:15:12	000:00:00:56
N10C58P45	N100C58P25	02/20/98 16:14:16	02/20/98 16:15:12	000:00:00:56
N10C58P46	N100C58P24	02/20/98 16:14:16	02/20/98 16:15:12	000:00:00:56
N10C58P24	N100C58P46	02/20/98 16:13:54	02/20/98 16:15:13	000:00:01:19
N10C58P26	N100C58P45	02/20/98 16:18:32	02/20/98 16:19:30	000:00:00:58
N10C58P27	N100C58P44	02/20/98 16:18:32	02/20/98 16:19:30	000:00:00:58
N10C58P28	N100C58P43	02/20/98 16:18:32	02/20/98 16:19:30	000:00:00:58
N10C58P29	N100C58P42	02/20/98 16:18:32	02/20/98 16:19:30	000:00:00:58
N10C58P30	N100C58P41	02/20/98 16:18:32	02/20/98 16:19:30	000:00:00:58
N10C58P31	N100C58P40	02/20/98 16:18:32	02/20/98 16:19:30	000:00:00:58
N10C58P32	N100C58P39	02/20/98 16:18:35	02/20/98 16:19:31	000:00:00:56
N10C58P33	N100C58P38	02/20/98 16:18:35	02/20/98 16:19:31	000:00:00:56
N10C58P34	N100C58P37	02/20/98 16:18:35	02/20/98 16:19:31	000:00:00:56
N10C58P35	N100C58P36	02/20/98 16:18:35	02/20/98 16:19:31	000:00:00:56
N10C58P36	N100C58P35	02/20/98 16:18:36	02/20/98 16:19:32	000:00:00:56
N10C58P37	N100C58P34	02/20/98 16:18:36	02/20/98 16:19:32	000:00:00:56
N10C58P38	N100C58P33	02/20/98 16:18:37	02/20/98 16:19:32	000:00:00:55
N10C58P39	N100C58P32	02/20/98 16:18:38	02/20/98 16:19:32	000:00:00:54
N10C58P40	N100C58P31	02/20/98 16:18:37	02/20/98 16:19:32	000:00:00:55
˙˙�C58P41	N100C58P30	02/20/98 16:18:38	02/20/98 16:19:32	000:00:00:54
ˌ58P42	N100C58P29	02/20/98 16:18:38	02/20/98 16:19:32	000:00:00:54
ₙ₁0C58P43	N100C58P28	02/20/98 16:18:39	02/20/98 16:19:32	000:00:00:53
N10C58P44	N100C58P27	02/20/98 16:18:40	02/20/98 16:19:33	000:00:00:53
N10C58P45	N100C58P26	02/20/98 16:18:40	02/20/98 16:19:33	000:00:00:53
N10C58P46	N100C58P25	02/20/98 16:18:40	02/20/98 16:19:33	000:00:00:53
N10C58P25	N100C58P46	02/20/98 16:18:18	02/20/98 16:19:34	000:00:01:16

From 02/16/98 00:00:00 to 02/23/98 23:59:00

Origination Port	Termination Port	Connect Time mm/dd/yy hh:mm:ss	Disconnect Time mm/dd/yy hh:mm:ss	Duration ddd:hh:mm:ss
N10C58P26	N100C58P45	02/20/98 16:21:21	02/20/98 16:23:30	000:00:02:09
N10C58P27	N100C58P44	02/20/98 16:21:22	02/20/98 16:23:31	000:00:02:09
N10C58P28	N100C58P43	02/20/98 16:21:22	02/20/98 16:23:31	000:00:02:09
N10C58P29	N100C58P42	02/20/98 16:21:22	02/20/98 16:23:31	000:00:02:09
N10C58P30	N100C58P41	02/20/98 16:21:22	02/20/98 16:23:31	000:00:02:09
N10C58P31	N100C58P40	02/20/98 16:21:22	02/20/98 16:23:31	000:00:02:09
N10C58P32	N100C58P39	02/20/98 16:21:24	02/20/98 16:23:31	000:00:02:07
N10C58P33	N100C58P38	02/20/98 16:21:24	02/20/98 16:23:31	000:00:02:07
N10C58P34	N100C58P37	02/20/98 16:21:24	02/20/98 16:23:31	000:00:02:07
N10C58P35	N100C58P36	02/20/98 16:21:25	02/20/98 16:23:31	000:00:02:06
N10C58P36	N100C58P35	02/20/98 16:21:25	02/20/98 16:23:32	000:00:02:07
N10C58P37	N100C58P34	02/20/98 16:21:25	02/20/98 16:23:32	000:00:02:07
N10C58P38	N100C58P33	02/20/98 16:21:27	02/20/98 16:23:33	000:00:02:06
N10C58P39	N100C58P32	02/20/98 16:21:27	02/20/98 16:23:33	000:00:02:06
N10C58P40	N100C58P31	02/20/98 16:21:27	02/20/98 16:23:33	000:00:02:06
N10C58P41	N100C58P30	02/20/98 16:21:28	02/20/98 16:23:34	000:00:02:06
N10C58P42	N100C58P29	02/20/98 16:21:28	02/20/98 16:23:34	000:00:02:06
:58P43	N100C58P28	02/20/98 16:21:28	02/20/98 16:23:34	000:00:02:06
C58P44	N100C58P27	02/20/98 16:21:29	02/20/98 16:23:34	000:00:02:05
N10C58P45	N100C58P26	02/20/98 16:21:30	02/20/98 16:23:34	000:00:02:04
N10C58P46	N100C58P25	02/20/98 16:21:30	02/20/98 16:23:34	000:00:02:04
N10C58P25	N100C58P46	02/20/98 16:21:08	02/20/98 16:23:38	000:00:02:30
N10C58P47	N10C43P5	02/19/98 09:50:39	02/20/98 16:40:23	001:06:49:44
N10C27P2	N100C27P0	12/17/97 15:58:59	02/20/98 16:46:48	065:00:47:49
N10C27P2	N100C27P0	02/20/98 16:47:49	02/20/98 16:49:00	000:00:01:11
N10C58P47	N10C43P5	02/20/98 16:41:13	02/20/98 17:20:47	000:00:39:34
N10C59P6	N60C43P1	02/01/98 11:28:36	02/20/98 17:22:35	019:05:53:59
N10C58P47	N10C59P6	02/20/98 17:23:17	02/20/98 17:24:56	000:00:01:39
N10C58P25	N100C58P25	02/20/98 17:33:33	02/20/98 17:34:55	000:00:01:22
N10C58P26	N100C58P26	02/20/98 17:33:33	02/20/98 17:34:55	000:00:01:22
N10C58P27	N100C58P27	02/20/98 17:33:34	02/20/98 17:34:56	000:00:01:22
N10C58P28	N100C58P28	02/20/98 17:33:34	02/20/98 17:34:56	000:00:01:22
N10C58P29	N100C58P29	02/20/98 17:33:34	02/20/98 17:34:56	000:00:01:22
N10C58P30	N100C58P30	02/20/98 17:33:34	02/20/98 17:34:56	000:00:01:22
N10C58P31	N100C58P31	02/20/98 17:33:36	02/20/98 17:34:56	000:00:01:20
N10C58P32	N100C58P32	02/20/98 17:33:36	02/20/98 17:34:56	000:00:01:20
N10C58P33	N100C58P33	02/20/98 17:33:36	02/20/98 17:34:56	000:00:01:20
N10C58P34	N100C58P34	02/20/98 17:33:37	02/20/98 17:34:57	000:00:01:20
N10C58P35	N100C58P35	02/20/98 17:33:37	02/20/98 17:34:57	000:00:01:20
N10C58P36	N100C58P36	02/20/98 17:33:37	02/20/98 17:34:57	000:00:01:20
N10C58P37	N100C58P37	02/20/98 17:33:38	02/20/98 17:34:57	000:00:01:19
N10C58P38	N100C58P38	02/20/98 17:33:39	02/20/98 17:34:57	000:00:01:18
:C58P39	N100C58P39	02/20/98 17:33:39	02/20/98 17:34:58	000:00:01:19
:58P40	N100C58P40	02/20/98 17:33:39	02/20/98 17:34:58	000:00:01:19
N10C58P41	N100C58P41	02/20/98 17:33:40	02/20/98 17:34:58	000:00:01:18
N10C58P42	N100C58P42	02/20/98 17:33:41	02/20/98 17:34:59	000:00:01:18
N10C58P43	N100C58P43	02/20/98 17:33:42	02/20/98 17:35:00	000:00:01:18
N10C58P44	N100C58P44	02/20/98 17:33:42	02/20/98 17:35:00	000:00:01:18
N10C58P45	N100C58P45	02/20/98 17:33:42	02/20/98 17:35:00	000:00:01:18

Call Duration Report for device N10
Mon Feb 23 11:59:41 1998

From 02/16/98 00:00:00 to 02/23/98 23:59:00

Origination Port	Termination Port	Connect Time mm/dd/yy hh:mm:ss	Disconnect Time mm/dd/yy hh:mm:ss	Duration ddd:hh:mm:ss
N10C58P46	N100C58P46	02/20/98 17:33:42	02/20/98 17:35:00	000:00:01:18
N10C58P24	N100C58P24	02/20/98 17:33:19	02/20/98 17:35:00	000:00:01:41
N10C58P25	N100C58P25	02/20/98 17:38:55	02/20/98 17:40:42	000:00:01:47
N10C58P26	N100C58P26	02/20/98 17:38:56	02/20/98 17:40:43	000:00:01:47
N10C58P27	N100C58P27	02/20/98 17:38:56	02/20/98 17:40:43	000:00:01:47
N10C58P28	N100C58P28	02/20/98 17:38:56	02/20/98 17:40:43	000:00:01:47
N10C58P29	N100C58P29	02/20/98 17:38:56	02/20/98 17:40:43	000:00:01:47
N10C58P30	N100C58P30	02/20/98 17:38:56	02/20/98 17:40:43	000:00:01:47
N10C58P31	N100C58P31	02/20/98 17:38:58	02/20/98 17:40:43	000:00:01:45
N10C58P32	N100C58P32	02/20/98 17:38:58	02/20/98 17:40:44	000:00:01:46
N10C58P33	N100C58P33	02/20/98 17:38:59	02/20/98 17:40:45	000:00:01:46
N10C58P34	N100C58P34	02/20/98 17:38:59	02/20/98 17:40:45	000:00:01:46
N10C58P35	N100C58P35	02/20/98 17:38:59	02/20/98 17:40:45	.000:00:01:46
N10C58P36	N100C58P36	02/20/98 17:38:59	02/20/98 17:40:45	000:00:01:46
N10C58P37	N100C58P37	02/20/98 17:39:01	02/20/98 17:40:46	000:00:01:45
N10C58P38	N100C58P38	02/20/98 17:39:01	02/20/98 17:40:46	000:00:01:45
N10C58P39	N100C58P39	02/20/98 17:39:01	02/20/98 17:40:46	000:00:01:45
1C58P40	N100C58P40	02/20/98 17:39:02	02/20/98 17:40:46	000:00:01:44
JC58P41	N100C58P41	02/20/98 17:39:02	02/20/98 17:40:47	000:00:01:45
N10C58P42	N100C58P42	02/20/98 17:39:02	02/20/98 17:40:47	000:00:01:45
N10C58P43	N100C58P43	02/20/98 17:39:03	02/20/98 17:40:47	000:00:01:44
N10C58P44	N100C58P44	02/20/98 17:39:03	02/20/98 17:40:47	000:00:01:44
N10C58P45	N100C58P45	02/20/98 17:39:04	02/20/98 17:40:47	000:00:01:43
N10C58P46	N100C58P46	02/20/98 17:39:04	02/20/98 17:40:48	000:00:01:44
N10C58P24	·N100C58P24	02/20/98 17:38:41	02/20/98 17:40:48	000:00:02:07
N10C58P25	N100C58P25	02/20/98 17:53:36	02/20/98 17:55:54	000:00:02:18
N10C58P26	N100C58P26	02/20/98 17:53:37	02/20/98 17:55:55	000:00:02:18
N10C58P27	N100C58P27	02/20/98 17:53:37	02/20/98 17:55:55	000:00:02:18
N10C58P28	N100C58P28	02/20/98 17:53:37	02/20/98 17:55:55	000:00:02:18
N10C58P29	N100C58P29	02/20/98 17:53:38	02/20/98 17:55:55	000:00:02:17
N10C58P30	N100C58P30	02/20/98 17:53:38	02/20/98 17:55:55	000:00:02:17
N10C58P31	N100C58P31	02/20/98 17:53:40	02/20/98 17:55:56	000:00:02:16
N10C58P32	N100C58P32	02/20/98 17:53:40	02/20/98 17:55:56	000:00:02:16
N10C58P33	N100C58P33	02/20/98 17:53:40	02/20/98 17:55:56	000:00:02:16
N10C58P34	N100C58P34	02/20/98 17:53:40	02/20/98 17:55:57	000:00:02:17
N10C58P35	N100C58P35	02/20/98 17:53:40	02/20/98 17:55:57	000:00:02:17
N10C58P36	N100C58P36	02/20/98 17:53:41	02/20/98 17:55:57	000:00:02:16
N10C58P37	N100C58P37	02/20/98 17:53:42	02/20/98 17:55:57	000:00:02:15
N10C58P38	N100C58P38	02/20/98 17:53:42	02/20/98 17:55:57	000:00:02:15
N10C58P39	N100C58P39	02/20/98 17:53:43	02/20/98 17:55:58	000:00:02:15
N10C58P40	N100C58P40	02/20/98 17:53:43	02/20/98 17:55:59	000:00:02:16
N10C58P41	N100C58P41	02/20/98 17:53:43	02/20/98 17:55:59	000:00:02:16
··10C58P42	N100C58P42	02/20/98 17:53:43	02/20/98 17:55:59	000:00:02:16
./C58P43	N100C58P43	02/20/98 17:53:45	02/20/98 17:56:00	000:00:02:15
N10C58P44	N100C58P44	02/20/98 17:53:46	02/20/98 17:56:00	000:00:02:14
N10C58P45	N100C58P45	02/20/98 17:53:46	02/20/98 17:56:00	000:00:02:14
N10C58P46	N100C58P46	02/20/98 17:53:46	02/20/98 17:56:00	000:00:02:14
N10C58P24	N100C58P24	02/20/98 17:53:23	02/20/98 17:56:00	000:00:02:37
N10C55P1	N20C39P0	02/05/98 16:22:41	02/20/98 19:55:44	015:03:33:03

```
            Call Duration Report for device N10
                 Mon Feb 23 11:59:41 1998

           From 02/16/98 00:00:00 to 02/23/98 23:59:00


Origination   Termination   Connect Time      Disconnect Time    Duration
Port          Port          mm/dd/yy hh:mm:ss mm/dd/yy hh:mm:ss  ddd:hh:mm:ss


N10C55P1      N20C39P0      02/20/98 20:00:15 02/20/98 20:00:23  000:00:00:08
N10C39P6      N10C55P0      01/28/98 18:21:41 02/20/98 22:27:18  023:04:05:37
N10C55P1      N20C39P0      02/20/98 20:05:24 02/20/98 22:27:18  000:02:21:54
N10C55P2      N51C10P0      02/03/98 10:55:05 02/20/98 22:27:18  017:11:32:13
N10C55P3      N14C10P0      02/17/98 19:56:36 02/20/98 22:27:18  003:02:30:42
N10C55P4      N83C10P0      01/30/98 14:32:14 02/20/98 22:27:18  021:07:55:04
N10C55P5      N60C39P0      02/01/98 11:28:25 02/20/98 22:27:18  019:10:58:53
N10C55P8      N80C10P0      02/02/98 14:47:44 02/20/98 22:27:18  018:07:39:34
N10C70P0      N10C55P11     12/17/97 15:58:02 02/20/98 22:27:18  065:06:29:16
N10C70P1      N10C55P15     12/17/97 15:58:02 02/20/98 22:27:18  065:06:29:16
N10C39P5      N19C10P0      12/24/97 19:28:32 02/21/98 16:38:20  058:21:09:48
N10C58P25     N100C58P25    02/22/98 04:26:24 02/22/98 04:27:19  000:00:00:55
N10C58P26     N100C58P26    02/22/98 04:26:24 02/22/98 04:27:19  000:00:00:55
N10C58P27     N100C58P27    02/22/98 04:26:24 02/22/98 04:27:19  000:00:00:55
N10C58P28     N100C58P28    02/22/98 04:26:24 02/22/98 04:27:19  000:00:00:55
N10C58P29     N100C58P29    02/22/98 04:26:24 02/22/98 04:27:19  000:00:00:55
N10C58P30     N100C58P30    02/22/98 04:26:24 02/22/98 04:27:19  000:00:00:55
'C58P31       N100C58P31    02/22/98 04:26:26 02/22/98 04:27:19  000:00:00:53
.0C58P32      N100C58P32    02/22/98 04:26:26 02/22/98 04:27:20  000:00:00:54
N10C58P33     N100C58P33    02/22/98 04:26:26 02/22/98 04:27:20  000:00:00:54
N10C58P34     N100C58P34    02/22/98 04:26:27 02/22/98 04:27:20  000:00:00:53
N10C58P35     N100C58P35    02/22/98 04:26:27 02/22/98 04:27:20  000:00:00:53
N10C58P36     N100C58P36    02/22/98 04:26:27 02/22/98 04:27:20  000:00:00:53
N10C58P37     N100C58P37    02/22/98 04:26:28 02/22/98 04:27:20  000:00:00:52
N10C58P38     N100C58P38    02/22/98 04:26:29 02/22/98 04:27:21  000:00:00:52
N10C58P39     N100C58P39    02/22/98 04:26:29 02/22/98 04:27:21  000:00:00:52
N10C58P40     N100C58P40    02/22/98 04:26:30 02/22/98 04:27:22  000:00:00:52
N10C58P41     N100C58P41    02/22/98 04:26:30 02/22/98 04:27:22  000:00:00:52
N10C58P42     N100C58P42    02/22/98 04:26:30 02/22/98 04:27:22  000:00:00:52
N10C58P43     N100C58P43    02/22/98 04:26:32 02/22/98 04:27:23  000:00:00:51
N10C58P44     N100C58P44    02/22/98 04:26:32 02/22/98 04:27:23  000:00:00:51
N10C58P45     N100C58P45    02/22/98 04:26:32 02/22/98 04:27:24  000:00:00:52
N10C58P46     N100C58P46    02/22/98 04:26:33 02/22/98 04:27:24  000:00:00:51
N10C58P24     N100C58P24    02/22/98 04:26:10 02/22/98 04:27:24  000:00:01:14
N10C55P8      N80C10P0      02/20/98 22:27:59 02/22/98 12:27:46  001:13:59:47
N10C43P4      N80C22P0      02/19/98 09:49:45 02/22/98 12:27:46  003:02:38:01
N10C58P25     N100C58P25    02/23/98 02:54:46 02/23/98 02:57:02  000:00:02:16
N10C58P26     N100C58P26    02/23/98 02:54:47 02/23/98 02:57:03  000:00:02:16
N10C58P27     N100C58P27    02/23/98 02:54:47 02/23/98 02:57:03  000:00:02:16
N10C58P28     N100C58P28    02/23/98 02:54:47 02/23/98 02:57:03  000:00:02:16
N10C58P29     N100C58P29    02/23/98 02:54:47 02/23/98 02:57:03  000:00:02:16
N10C58P30     N100C58P30    02/23/98 02:54:47 02/23/98 02:57:03  000:00:02:16
'C58P31       N100C58P31    02/23/98 02:54:49 02/23/98 02:57:03  000:00:02:14
C58P32        N100C58P32    02/23/98 02:54:50 02/23/98 02:57:05  000:00:02:15
N10C58P33     N100C58P33    02/23/98 02:54:50 02/23/98 02:57:05  000:00:02:15
N10C58P34     N100C58P34    02/23/98 02:54:51 02/23/98 02:57:05  000:00:02:14
N10C58P35     N100C58P35    02/23/98 02:54:51 02/23/98 02:57:05  000:00:02:14
N10C58P36     N100C58P36    02/23/98 02:54:51 02/23/98 02:57:06  000:00:02:15
N10C58P37     N100C58P37    02/23/98 02:54:52 02/23/98 02:57:06  000:00:02:14
```

From 02/16/98 00:00:00 to 02/23/98 23:59:00

Origination Port	Termination Port	Connect Time mm/dd/yy hh:mm:ss	Disconnect Time mm/dd/yy hh:mm:ss	Duration ddd:hh:mm:ss
N10C58P38	N100C58P38	02/23/98 02:54:52	02/23/98 02:57:06	000:00:02:14
N10C58P39	N100C58P39	02/23/98 02:54:53	02/23/98 02:57:07	000:00:02:14
N10C58P40	N100C58P40	02/23/98 02:54:53	02/23/98 02:57:07	000:00:02:14
N10C58P41	N100C58P41	02/23/98 02:54:53	02/23/98 02:57:07	000:00:02:14
N10C58P42	N100C58P42	02/23/98 02:54:53	02/23/98 02:57:07	000:00:02:14
N10C58P43	N100C58P43	02/23/98 02:54:54	02/23/98 02:57:07	000:00:02:13
N10C58P44	N100C58P44	02/23/98 02:54:56	02/23/98 02:57:08	000:00:02:12
N10C58P45	N100C58P45	02/23/98 02:54:56	02/23/98 02:57:08	000:00:02:12
N10C58P46	N100C58P46	02/23/98 02:54:56	02/23/98 02:57:08	000:00:02:12
N10C58P24	N100C58P24	02/23/98 02:54:33	02/23/98 02:57:09	000:00:02:36
N10C25P41	N100C57P5	02/23/98 06:53:58	02/23/98 06:54:28	000:00:00:30
N10C25P42	N100C57P4	02/23/98 06:53:58	02/23/98 06:54:29	000:00:00:31
N10C25P43	N100C57P3	02/23/98 06:53:57	02/23/98 06:54:29	000:00:00:32
N10C25P44	N100C57P2	02/23/98 06:53:57	02/23/98 06:54:29	000:00:00:32
N10C25P45	N100C57P1	02/23/98 06:53:57	02/23/98 06:54:30	000:00:00:33
N10C25P46	N100C57P0	02/23/98 06:53:55	02/23/98 06:54:30	000:00:00:35
N10C25P41	N100C57P5	02/23/98 07:14:56	02/23/98 08:04:31	000:00:49:35
C25P42	N100C57P4	02/23/98 07:14:55	02/23/98 08:04:31	000:00:49:36
JC25P43	N100C57P3	02/23/98 07:14:56	02/23/98 08:04:32	000:00:49:36
N10C25P44	N100C57P2	02/23/98 07:14:55	02/23/98 08:04:32	000:00:49:37
N10C25P45	N100C57P1	02/23/98 07:14:54	02/23/98 08:04:32	000:00:49:38
N10C25P46	N100C57P0	02/23/98 07:14:53	02/23/98 08:04:33	000:00:49:40
N10C25P46	N82C20P0	02/23/98 08:16:41	02/23/98 08:17:15	000:00:00:34
N10C25P41	N82C20P5	02/23/98 08:16:46	02/23/98 08:17:16	000:00:00:30
N10C25P42	N82C20P4	02/23/98 08:16:44	02/23/98 08:17:16	000:00:00:32
N10C25P43	N82C20P3	02/23/98 08:16:44	02/23/98 08:17:16	000:00:00:32
N10C25P44	N82C20P2	02/23/98 08:16:44	02/23/98 08:17:17	000:00:00:33
N10C25P45	N82C20P1	02/23/98 08:16:43	02/23/98 08:17:17	000:00:00:34
N10C25P46	N82C20P0	02/23/98 08:18:53	02/23/98 09:17:15	000:00:58:22
N10C25P41	N82C20P5	02/23/98 08:18:57	02/23/98 09:17:16	000:00:58:19
N10C25P42	N82C20P4	02/23/98 08:18:57	02/23/98 09:17:16	000:00:58:19
N10C25P43	N82C20P3	02/23/98 08:18:56	02/23/98 09:17:16	000:00:58:20
N10C25P44	N82C20P2	02/23/98 08:18:55	02/23/98 09:17:16	000:00:58:21
N10C25P45	N82C20P1	02/23/98 08:18:56	02/23/98 09:17:17	000:00:58:21
N10C58P25	N100C58P25	02/23/98 09:18:15	02/23/98 09:25:09	000:00:06:54
N10C58P26	N100C58P26	02/23/98 09:18:15	02/23/98 09:25:09	000:00:06:54
N10C58P27	N100C58P27	02/23/98 09:18:15	02/23/98 09:25:09	000:00:06:54
N10C58P28	N100C58P28	02/23/98 09:18:15	02/23/98 09:25:09	000:00:06:54
N10C58P29	N100C58P29	02/23/98 09:18:15	02/23/98 09:25:09	000:00:06:54
N10C58P30	N100C58P30	02/23/98 09:18:16	02/23/98 09:25:09	000:00:06:53
N10C58P31	N100C58P31	02/23/98 09:18:17	02/23/98 09:25:09	000:00:06:52
N10C58P32	N100C58P32	02/23/98 09:18:18	02/23/98 09:25:10	000:00:06:52
?C58P33	N100C58P33	02/23/98 09:18:18	02/23/98 09:25:10	000:00:06:52
?C58P34	N100C58P34	02/23/98 09:18:18	02/23/98 09:25:10	000:00:06:52
?10C58P35	N100C58P35	02/23/98 09:18:18	02/23/98 09:25:10	000:00:06:52
N10C58P36	N100C58P36	02/23/98 09:18:20	02/23/98 09:25:11	000:00:06:51
N10C58P37	N100C58P37	02/23/98 09:18:21	02/23/98 09:25:11	000:00:06:50
N10C58P38	N100C58P38	02/23/98 09:18:21	02/23/98 09:25:11	000:00:06:50
N10C58P39	N100C58P39	02/23/98 09:18:21	02/23/98 09:25:11	000:00:06:50

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                    Call Duration Report for device N10
                        Mon Feb 23 11:59:41 1998


                   From 02/16/98 00:00:00 to 02/23/98 23:59:00


Origination    Termination    Connect Time         Disconnect Time      Duration
Port           Port           mm/dd/yy hh:mm:ss     mm/dd/yy hh:mm:ss    ddd:hh:mm:ss


N10C58P40      N100C58P40     02/23/98 09:18:22     02/23/98 09:25:11    000:00:06:49
N10C58P41      N100C58P41     02/23/98 09:18:22     02/23/98 09:25:11    000:00:06:49
N10C58P42      N100C58P42     02/23/98 09:18:22     02/23/98 09:25:12    000:00:06:50
N10C58P43      N100C58P43     02/23/98 09:18:23     02/23/98 09:25:12    000:00:06:49
N10C58P44      N100C58P44     02/23/98 09:18:24     02/23/98 09:25:12    000:00:06:48
N10C58P45      N100C58P45     02/23/98 09:18:23     02/23/98 09:25:12    000:00:06:49
N10C58P46      N100C58P46     02/23/98 09:18:24     02/23/98 09:25:13    000:00:06:49
N10C58P24      N100C58P24     02/23/98 09:18:01     02/23/98 09:25:13    000:00:07:12
N10C58P25      N100C58P25     02/23/98 09:34:02     02/23/98 09:35:25    000:00:01:23
N10C58P26      N100C58P26     02/23/98 09:34:02     02/23/98 09:35:25    000:00:01:23
N10C58P27      N100C58P27     02/23/98 09:34:03     02/23/98 09:35:26    000:00:01:23
N10C58P28      N100C58P28     02/23/98 09:34:03     02/23/98 09:35:26    000:00:01:23
N10C58P29      N100C58P29     02/23/98 09:34:03     02/23/98 09:35:26    000:00:01:23
N10C58P30      N100C58P30     02/23/98 09:34:03     02/23/98 09:35:26    000:00:01:23
N10C58P31      N100C58P31     02/23/98 09:34:05     02/23/98 09:35:26    000:00:01:21
N10C58P32      N100C58P32     02/23/98 09:34:05     02/23/98 09:35:26    000:00:01:21
N10C58P33      N100C58P33     02/23/98 09:34:05     02/23/98 09:35:26    000:00:01:21
`C58P34        N100C58P34     02/23/98 09:34:05     02/23/98 09:35:26    000:00:01:21
.C58P35        N100C58P35     02/23/98 09:34:06     02/23/98 09:35:27    000:00:01:21
N10C58P36      N100C58P36     02/23/98 09:34:06     02/23/98 09:35:27    000:00:01:21
N10C58P37      N100C58P37     02/23/98 09:34:07     02/23/98 09:35:27    000:00:01:20
N10C58P38      N100C58P38     02/23/98 09:34:07     02/23/98 09:35:27    000:00:01:20
N10C58P39      N100C58P39     02/23/98 09:34:07     02/23/98 09:35:27    000:00:01:20   .
N10C58P40      N100C58P40     02/23/98 09:34:09     02/23/98 09:35:28    000:00:01:19
N10C58P41      N100C58P41     02/23/98 09:34:08     02/23/98 09:35:28    000:00:01:20
N10C58P42      N100C58P42     02/23/98 09:34:09     02/23/98 09:35:28    000:00:01:19
N10C58P43      N100C58P43     02/23/98 09:34:10     02/23/98 09:35:29    000:00:01:19
N10C58P44      N100C58P44     02/23/98 09:34:10     02/23/98 09:35:29    000:00:01:19
N10C58P45      N100C58P45     02/23/98 09:34:10     02/23/98 09:35:29    000:00:01:19
N10C58P46      N100C58P46     02/23/98 09:34:11     02/23/98 09:35:30    000:00:01:19
N10C58P24      N100C58P24     02/23/98 09:33:48     02/23/98 09:35:30    000:00:01:42
N10C58P25      N100C58P25     02/23/98 09:36:18     02/23/98 09:38:18    000:00:02:00
N10C58P26      N100C58P26     02/23/98 09:36:18     02/23/98 09:38:18    000:00:02:00
N10C58P27      N100C58P27     02/23/98 09:36:18     02/23/98 09:38:18    000:00:02:00
N10C58P28      N100C58P28     02/23/98 09:36:18     02/23/98 09:38:18    000:00:02:00
N10C58P29      N100C58P29     02/23/98 09:36:19     02/23/98 09:38:18    000:00:01:59
N10C58P30      N100C58P30     02/23/98 09:36:19     02/23/98 09:38:18    000:00:01:59
N10C58P31      N100C58P31     02/23/98 09:36:21     02/23/98 09:38:19    000:00:01:58
N10C58P32      N100C58P32     02/23/98 09:36:21     02/23/98 09:38:19    000:00:01:58
N10C58P33      N100C58P33     02/23/98 09:36:21     02/23/98 09:38:19    000:00:01:58
N10C58P34      N100C58P34     02/23/98 09:36:22     02/23/98 09:38:21    000:00:01:59
N10C58P35      N100C58P35     02/23/98 09:36:22     02/23/98 09:38:21    000:00:01:59
``0C58P36      N100C58P36     02/23/98 09:36:22     02/23/98 09:38:21    000:00:01:59
C58P37         N100C58P37     02/23/98 09:36:24     02/23/98 09:38:21    000:00:01:57
..0C58P38      N100C58P38     02/23/98 09:36:24     02/23/98 09:38:21    000:00:01:57
N10C58P39      N100C58P39     02/23/98 09:36:24     02/23/98 09:38:22    000:00:01:58
N10C58P40      N100C58P40     02/23/98 09:36:24     02/23/98 09:38:22    000:00:01:58
N10C58P41      N100C58P41     02/23/98 09:36:25     02/23/98 09:38:23    000:00:01:58
N10C58P42      N100C58P42     02/23/98 09:36:25     02/23/98 09:38:23    000:00:01:58
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Call Duration Report for device N10
        Mon Feb 23 11:59:41 1998

From 02/16/98 00:00:00 to 02/23/98 23:59:00


Origination   Termination   Connect Time        Disconnect Time      Duration
Port          Port          mm/dd/yy hh:mm:ss    mm/dd/yy hh:mm:ss    ddd:hh:mm:ss


N10C58P43     N100C58P43    02/23/98 09:36:26    02/23/98 09:38:23    000:00:01:57
N10C58P44     N100C58P44    02/23/98 09:36:27    02/23/98 09:38:23    000:00:01:56
N10C58P45     N100C58P45    02/23/98 09:36:28    02/23/98 09:38:24    000:00:01:56
N10C58P46     N100C58P46    02/23/98 09:36:28    02/23/98 09:38:24    000:00:01:56
N10C58P24     N100C58P24    02/23/98 09:36:05    02/23/98 09:38:24    000:00:02:19
N10C58P25     N100C58P25    02/23/98 11:07:10    02/23/98 11:09:34    000:00:02:24
N10C58P26     N100C58P26    02/23/98 11:07:10    02/23/98 11:09:34    000:00:02:24
N10C58P27     N100C58P27    02/23/98 11:07:10    02/23/98 11:09:34    000:00:02:24
N10C58P28     N100C58P28    02/23/98 11:07:10    02/23/98 11:09:34    000:00:02:24
N10C58P29     N100C58P29    02/23/98 11:07:10    02/23/98 11:09:34    000:00:02:24
N10C58P30     N100C58P30    02/23/98 11:07:10    02/23/98 11:09:34    000:00:02:24
N10C58P31     N100C58P31    02/23/98 11:07:13    02/23/98 11:09:36    000:00:02:23
N10C58P32     N100C58P32    02/23/98 11:07:13    02/23/98 11:09:36    000:00:02:23
N10C58P33     N100C58P33    02/23/98 11:07:13    02/23/98 11:09:36    000:00:02:23
N10C58P34     N100C58P34    02/23/98 11:07:13    02/23/98 11:09:36    000:00:02:23
N10C58P35     N100C58P35    02/23/98 11:07:13    02/23/98 11:09:37    000:00:02:24
N10C58P36     N100C58P36    02/23/98 11:07:14    02/23/98 11:09:37    000:00:02:23
 ?C58P37      N100C58P37    02/23/98 11:07:15    02/23/98 11:09:37    000:00:02:22
 ,C58P38      N100C58P38    02/23/98 11:07:15    02/23/98 11:09:37    000:00:02:22
N10C58P39     N100C58P39    02/23/98 11:07:15    02/23/98 11:09:37    000:00:02:22
N10C58P40     N100C58P40    02/23/98 11:07:16    02/23/98 11:09:38    000:00:02:22
N10C58P41     N100C58P41    02/23/98 11:07:16    02/23/98 11:09:38    000:00:02:22
N10C58P42     N100C58P42    02/23/98 11:07:16    02/23/98 11:09:38    000:00:02:22
N10C58P43     N100C58P43    02/23/98 11:07:17    02/23/98 11:09:38    000:00:02:21
N10C58P44     N100C58P44    02/23/98 11:07:18    02/23/98 11:09:38    000:00:02:20
N10C58P45     N100C58P45    02/23/98 11:07:19    02/23/98 11:09:39    000:00:02:20
N10C58P46     N100C58P46    02/23/98 11:07:19    02/23/98 11:09:39    000:00:02:20
N10C58P24     N100C58P24    02/23/98 11:06:55    02/23/98 11:09:39    000:00:02:44
```

APPENDIX U

BAMC CALL DURATION REPORT FOR 16-23 FEB 98

FRX Port	DLCI	Frames Delivered	Bytes Delivered	DE Frames Delivered	DE Bytes Delivered	Beginning of Report	Report Through
N10C39P7	308	91,677,659	2,327,298,956	0	0	10-Feb-98 16:58:46	25-Feb-98 17:58:46
N10C39P11	52	0	0	0	0	10-Feb-98 16:58:46	25-Feb-98 17:58:46
N10C39P11	70	2,013,245	339,997,100	0	0	10-Feb-98 16:58:46	25-Feb-98 17:58:46
N10C39P11	81	7,292,891	783,643,573	0	0	10-Feb-98 16:58:46	25-Feb-98 17:58:46
N10C39P11	82	10,276,315	1,271,355,744	0	0	10-Feb-98 16:58:46	25-Feb-98 17:58:46
N10C39P11	100	334,082	53,351,314	0	0	10-Feb-98 16:58:46	25-Feb-98 17:58:46
N10C39P11	101	3,028,838	1,048,786,595	0	0	10-Feb-98 16:58:46	25-Feb-98 17:58:46
N10C39P11	108	935,624	183,347,366	0	0	10-Feb-98 16:58:46	25-Feb-98 17:58:46
N10C39P11	311	163,516,220	2,982,119,184	0	0	10-Feb-98 16:58:46	25-Feb-98 17:58:46
N10C39P11	312	1,532,552	178,464,909	0	0	10-Feb-98 16:58:46	25-Feb-98 17:58:46
0C39P15	100	43,204,097	2,652,721,876	0	0	10-Feb-98 16:58:46	25-Feb-98 17:58:46
N10C55P11	20	66,625	3,773,463	0	0	10-Feb-98 16:59:46	25-Feb-98 17:59:47
N10C55P11	21	5,645,344	1,365,011,854	0	0	10-Feb-98 16:59:46	25-Feb-98 17:59:47
N10C55P11	33	9,232,178	3,698,063,222	0	0	10-Feb-98 16:59:46	25-Feb-98 17:59:47
N10C55P11	51	8,597,525	1,101,248,211	0	0	10-Feb-98 16:59:46	25-Feb-98 17:59:47
N10C55P11	80	5,048,554	743,368,430	0	0	10-Feb-98 16:59:46	25-Feb-98 17:59:47
N10C55P11	83	9,244,238	1,291,021,766	0	0	10-Feb-98 16:59:46	25-Feb-98 17:59:47
N10C55P11	100	144,360	10,022,164	0	0	10-Feb-98 16:59:46	25-Feb-98 17:59:47

FRX Port	DLCI	Frames Delivered	Bytes Delivered	DE Frames Delivered	DE Bytes Delivered	Beginning of Report	Report Through
N10C55P11	104	476,384	47,626,721	0	0	10-Feb-98 16:59:46	25-Feb-98 17:59:47
N10C55P11	112	0	0	0	0	10-Feb-98 16:59:46	18-Feb-98 15:59:46
N10C55P11	201	474,211	83,835,304	0	0	10-Feb-98 16:59:46	25-Feb-98 17:59:47
N10C55P11	314	6,466,411	854,590,809	0	0	10-Feb-98 16:59:46	25-Feb-98 17:59:47
N10C55P15	30	47,738,523	3,766,709,978	0	0	10-Feb-98 16:59:46	25-Feb-98 17:59:47
N10C55P15	460	73,705,775	2,760,254,933	0	0	10-Feb-98 16:59:46	25-Feb-98 17:59:47

APPENDIX V

SAMPLE GROUPING OF INITIATIVES BASED ON OBVIOUS

RELATIONSHIPS

(VTC, REAL-TIME, STORE-AND-FORWARD TELEMEDICINE)

GROUP INITIATIVE BY TYPE

No.	TITLE OF INITIATIVE	T-Med	VTC	Real-Time	Store-and-Forward
	VTC				
1	Grand Rounds/CME to MEDDACS		X	X	
2	DACM DOM RRC Requirements/Distance Learning		X	X	
3	DACH Continuity Clinic		X	X	
6	BAMC Research Ethics Course		X	X	
7	BAMC Institutional Review Board Meetings		X	X	
8	BAMC Preventive Medicine Conferences		X	X	
10	BAMC - WHMC Department of Radiology VTC		X	X	
16	DACH/BAMC - WHMC Peds Resident Teaching Conference		X	X	
17	BAMC Neurosurgery VTC Conference		X	X	
25	BAMC - GPRMC Health Promotion Education		X	X	
26	DACH Auditorium		X	X	
27	BAMC Nursing VTC/Distance learning		X	X	
30	DACH - WHMC TTVN VTC		X	X	
31	DACH -Texas A&M DACH Initiative		X	X	
	REAL-TIME				
4	BAMC Gastroenteroscopy Service T-Med	X		X	
5	BAMC Cardiology Service	X			
12	DACH - BAMC Department of Dermatology	X		X	
13	DACH Subspecialty Peds Clinic	X		X	
14	DACH NICU	X		X	
15	DACH - WH Pediatric Resident Continuity Clinics	X		X	
18	Ft. Carson - BAMC Urology	X		X	
19	Ft. Reiley - BAMC Urology	X		X	
20	Various - BAMC Opthalmology Consultations	X		X	
21	Various - BAMC Otolaryngologic Consultations	X		X	
23	BAMC - DACH Telepsychology	X		X	
24	BAMC - GPRMC Dental Clinic	X		X	
	STORE-AND-FORWARD				
9	DACH - BAMC Department of Radiology	X			X
11	BAMC Teleradiology with GPRMC	X			X
22	DACH - BAMC - AFIP Telepathology	X			X
28	4 ID TMC/MTMC to DACH to BAMC	X			X
29	AC3 - DACH T-Med/CHCS IFICS	X			X

APPENDIX W

DATA COLLECTION SUMMARY

BENEFIT OBJECTIVES

No.	Title	Compatibility	Multiple Uses	Performance	Reliability	Speed	Upgrade	Ease of Use	Integration IM/IS	Market Place	MOP	Patient Population	Political	Project Plan	Usage Level	Approval	Efficiency	Standards	Quality	Safety	Satisfaction	Security
1	Grand Rounds/CME to MEDDACS	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
2	DACM DOM RRC Requirements/Distance Learning	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
3	DACH Continuity Clinic	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
4	BAMC Gastroenteroscopy Service T-Med	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
5	BAMC Cardiology Service	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
6	BAMC Research Ethics Course	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
7	BAMC Institutional Review Board Meetings	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
8	BAMC Preventive Medicine Conferences	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
9	DACH - BAMC Department of Radiology	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
10	BAMC - WHMC Department of Radiology VTC	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
11	BAMC Teleradiology with GPRMC	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
12	DACH - BAMC Department of Dermatology	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
13	DACH Subspecialty Peds Clinic	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
14	DACH NICU	○	○	○	◍	○	○	○	○	○	○	●	○	○	○	○	○	○	○	○	○	○
15	DACH - WH Pediatric Resident Continuity Clinics	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
16	DACH/BAMC - WHMC Peds Resident Teaching Conf.	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
17	BAMC Neurosurgery VTC Conference	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
18	Ft. Carson - BAMC Urology	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
19	Ft. Reiley - BAMC Urology	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
20	Various - BAMC Opthalmology Consultations	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
21	Various - BAMC Otolaryngologic Consultations	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
22	DACH - BAMC - AFIP Telepathology	○	●	○	○	○	○	◍	○	○	○	○	○	○	○	○	○	○	○	○	○	○
23	BAMC - DACH Telepsychology	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
24	BAMC - GPRMC Dental Clinic	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
25	BAMC - GPRMC Health Promotion Education	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
26	DACH Auditorium	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
27	BAMC Nursing VTC/Distance learning	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
28	4 ID TMC/MTMC to DACH to BAMC	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
29	AC3 - DACH T-Med/CHCS IFICS	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
30	DACH - WHMC TTVN VTC	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	◍	○
31	DACH - Texas A&M DACH Initiative	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○

COST OBJECTIVES

No.	Title	Assembly	Customization	Maintenance	Size	Weight	Facility	Initial Capital	On-going Capital	Schedule	Training	Transmission $	Confinement	Clinician Inconv.	Delay	Discomfort	Movement	Patient Inconv.
1	Grand Rounds/CME to MEDDACS	○	○	○	○	○	○	○	○	○	○	○	○	○	◉	◉	◉	○
2	DACM DOM RRC Requirements/Distance Learning	○	○	○	○	○	○	○	○	○	○	○	○	○	○	◉	◉	○
3	DACH Continuity Clinic	○	○	○	○	○	○	○	○	○	○	○	○	○	○	◉	◉	○
4	BAMC Gastroenteroscopy Service T-Med	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
5	BAMC Cardiology Service	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
6	BAMC Research Ethics Course	○	○	○	○	○	○	○	○	○	○	○	○	○	◉	◉	◉	◉
7	BAMC Institutional Review Board Meetings	○	○	○	○	○	○	○	○	○	○	○	○	○	○	◉	◉	◉
8	BAMC Preventive Medicine Conferences	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
9	DACH - BAMC Department of Radiology	○	○	○	○	○	○	○	○	○	○	○	○	○	○	◉	◉	◉
10	BAMC - WHMC Department of Radiology VTC	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
11	BAMC Teleradiology with GPRMC	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
12	DACH - BAMC Department of Dermatology	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
13	DACH Subspecialty Peds Clinic	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
14	DACH NICU	○	○	○	○	◉	○	○	○	○	○	○	○	○	○	○	○	○
15	DACH - WH Pediatric Resident Continuity Clinics	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
16	DACH/BAMC - WHMC Peds Resident Teaching Conf.	○	○	○	○	○	○	○	○	○	○	○	○	○	○	◉	◉	○
17	BAMC Neurosurgery VTC Conference	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
18	Ft. Carson - BAMC Urology	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
19	Ft. Reiley - BAMC Urology	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
20	Various - BAMC Opthalmology Consultations	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
21	Various - BAMC Otolaryngologic Consultations	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
22	DACH - BAMC - AFIP Telepathology	◉	◉	○	◉	◉	◉	○	○	○	◉	○	○	○	○	◉	◉	◉
23	BAMC - DACH Telepsychology	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
24	BAMC - GPRMC Dental Clinic	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
25	BAMC - GPRMC Health Promotion Education	○	○	○	○	○	○	○	○	○	○	○	○	○	○	◉	◉	◉
26	DACH Auditorium	○	○	○	○	○	○	○	○	○	○	○	○	○	○	◉	◉	◉
27	BAMC Nursing VTC/Distance learning	○	○	○	○	○	○	○	○	○	○	○	○	○	○	◉	◉	◉
28	4 ID TMC/MTMC to DACH to BAMC	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
29	AC3 - DACH T-Med/CHCS IFICS	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
30	DACH - WHMC TTVN VTC	○	○	○	○	○	○	○	○	○	○	○	○	○	○	◉	◉	◉
31	DACH -Texas A&M DACH Initiative	○	○	○	○	○	○	○	○	○	○	○	○	○	○	◉	◉	◉

RISK OBJECTIVES

LEGEND

- ● Complete information - verified
- ◉ Complete information - not verified
- ○ Partial information
- ○ Unavailable information

No.	Title	Cost Risk	Schedule Risk	Technical Risk
1	Grand Rounds/CME to MEDDACS	○	○	○
2	DACM DOM RRC Requirements/Distance Learning	○	○	○
3	DACH Continuity Clinic	○	○	○
4	BAMC Gastroenteroscopy Service T-Med	○	○	○
5	BAMC Cardiology Service	○	○	○
6	BAMC Research Ethics Course	○	○	○
7	BAMC Institutional Review Board Meetings	○	○	○
8	BAMC Preventive Medicine Conferences	○	○	○
9	DACH - BAMC Department of Radiology	○	○	○
10	BAMC - WHMC Department of Radiology VTC	○	○	○
11	BAMC Teleradiology with GPRMC	○	○	○
12	DACH - BAMC Department of Dermatology	○	○	○
13	DACH Subspecialty Peds Clinic	○	○	○
14	DACH NICU	○	○	○
15	DACH - WH Pediatric Resident Continuity Clinics	○	○	○
16	DACH/BAMC - WHMC Peds Resident Teaching Conf.	○	○	○
17	BAMC Neurosurgery VTC Conference	○	○	○
18	Ft. Carson - BAMC Urology	○	○	○
19	Ft. Reiley - BAMC Urology	○	○	○
20	Various - BAMC Opthalmology Consultations	○	○	○
21	Various - BAMC Otolaryngologic Consultations	○	○	○
22	DACH - BAMC - AFIP Telepathology	○	○	○
23	BAMC - DACH Telepsychology	○	○	○
24	BAMC - GPRMC Dental Clinic	○	○	○
25	BAMC - GPRMC Health Promotion Education	○	○	○
26	DACH Auditorium	○	○	○
27	BAMC Nursing VTC/Distance learning	○	○	○
28	4 ID TMC/MTMC to DACH to BAMC	○	○	○
29	AC3 - DACH T-Med/CHCS IFICS	○	○	○
30	DACH - WHMC TTVN VTC	○	○	○
31	DACH - Texas A&M DACH Initiative	○	○	○